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A CASE OF IDIOPATHIC SPINAL HÆMORRHAGE.

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Hæmorrhage into the spinal cord of traumatic origin, while not of very frequent occurrence, has been noted often enough to establish the fact of its occurrence beyond a doubt. But as to whether hæmorrhage into or about the cord may take place without an antecedent traumatism some writers are in doubt. However, the majority of writers do admit that idiopathic spinal apoplexy may occur, but they are all in accord in stating that the affection occurs only very rarely.

In view of these facts I trust the case I am about to relate will prove to be of some value as tending to place the existence of the disease beyond the peradventure of a doubt.

Although the case is incomplete insomuch as no post-mortem record is included, yet I believe the clinical history alone will be sufficient to establish the diagnosis.

T. K., a laborer aged 51 years, had been in robust health and worked steadily up to the date of present illness. He is a tall man of rugged frame; habits of life good; never had syphilis nor any prolonged illness; heart normal.

March 12, 1891, after performing his ordinary day's work he went to bed feeling as well as usual. But instead of going to sleep in a few minutes as had been his habit, he remained awake, turning about the bed uneasily until 11 o'clock, when he was suddenly seized with an excruciating pain at about the first lumbar vertebra, which radiated from thence around the abdomen and down the thighs. He at once arose from bed in the intensity of his agony and rapidly walked up and down the room. After a few minutes he sat down upon the edge of the bed and bathed his feet in hot water which his wife had brought for him. While thus engaged, became nauseated and attempted to vomit several times but did not succeed. The gastric distress lasted only a few minutes. While his feet were yet in the water he noticed that they were becoming "numb," and told his wife about it. Upon attempting to stand up, soon afterwards, he became conscious of a diminution of power in his legs. He became greatly alarmed at this discovery and at once got into bed, and became aware, a few moments later, of the entire loss of motion and sensation in both legs. The pain rapidly lessened in intensity so that he was entirely free from it twenty-five minutes after the initial attack. The patient feels sure that his consciousness, his memory for words and ability to utter them, was never lost or even impaired during the attack. Members of his family bear him out in this statement. They are further in accord in stating that at no time was the motion or sensation in any of the organs above the umbilicus impaired. The loss of voluntary control of the bladder and bowels was noticed the next day and must have occurred coincidently with the pariplegia.

A critical examination the next day revealed the following conditions: Paralysis of motion complete in both legs; power in the abdominal muscles greatly impaired; anæsthesia of all kinds completely lost in both legs, impaired over lower half of abdomen. Patient is unable to expel urine or fæces; was not aware that both bladder and bowels needed emptying. No impairment of mental functions; no pain; motion and sensation in muscles of upper half of body unimpaired.

Subsequent history.—Pain never returned, save for an occasional twinge. Urine and fæces taken away regularly by mechanical means. The paralysis as described continued unchanged until about April 4 (three weeks after initial symptom) when the first signs of the return of muscular power were noted. Patient could at that time move toes of left foot. From this time up to the present date (May 1) there has been steady progress towards recovery. He can now move both legs about the bed, flex knees and thighs. Sensation has largely returned. He is not yet able to expel his urine and fæces, although the desire to micturate and defecate now comes to him.

Remarks.—The very sudden onset of the symptoms would preclude the possibility of the trouble being due to tumor, aneurism, bone disease

or myelitis. An embolus would produce sudden symptoms, but it would be highly improbable that trouble of this kind could cause such a complete condition of paraplegia in less than half an hour. So I am forced to conclude that the lesion was a hæmorrhage—and a large one—either in the cord itself or in the structure immediately surrounding it. I am inclined to think the hæmorrhage occurred in the cord itself. As to the part of the cord involved, the symptoms would indicate the lower part of the dorsal region.

THE DIAGNOSIS OF TRAUMATIC LESIONS IN THE CEREBRO-SPINAL AXIS AND THE DETECTION OF MALINGERING REFERRED TO THIS CENTRE.

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The counterfeit can not be detected without an accurate knowledge of the genuine, and in addition to this an exact knowledge of the counterfeit, and likewise a definite knowledge of the difference between the genuine and counterfeit, is still imperatively required.

It therefore follows that he who would attempt to detect malingering should always be able to diagnose concussion of the brain and spinal cord. The proper performance of this task requires a full knowledge of the etiology, semeiology and pathology of the morbid condition under consideration. Let us, therefore, direct our attention to these essential factors of diagnosis—carefully analyzing each—in order that we may more thoroughly comprehend their relation and bearing on each other. It is universally admitted that concussion of the spinal cord most commonly follows falls upon the feet, buttocks, less frequently on the hands when both arms are outstretched, gun-shot wounds involving portions of the spinal column, a stroke of lightning, heavy blows delivered over the bones of the pelvis or in the line of the spinal column, etc. The direct effect of these falls and blows is the production of contusions of the soft parts, etc., which are more or less disorganized by these traumatic agents. The force of these agents is not by any means entirely expended in the production of these contusions, but there will be carried along the bony structure a vibratory motion which will also be imparted in varying degrees to the adjacent soft parts. A very fair idea may be gained of these vibratory movements by placing the hand on the apex of a bell, suspended in the air, while its base is struck with a metallic hammer; or by the touch of a properly keyed string of a musical instrument when it has been put in motion. The same vibratory motion may be likewise very well illustrated by tapping gently with the finger on a glass jar or other vessel which is partially filled with jelly, and then watching the tremulous movements imparted to the contents by the slight blows delivered on the vessel. The attention of the medical profession has been very frequently called to the peculiarities of concussive or vibratory force by French authors, but its physiological and pathological action has never received that careful study to which it is entitled. A very important factor, which presents itself for our consideration in connection with study of this force is, the fact that it is not transmitted equally well by the various organs and tissues of animal bodies; and, consequently, a direct blow delivered on one part of the body may be entirely negative or result in the production of very little vibratory action, while on another part of the organism the results will be very marked. Thus a blow delivered directly on the nates will give rise to the concussive force and be transmitted along the spinal column to the bony walls of the skull, and from this structure to the brain itself, which is in such close contact with these bones. A portion of the same force will likewise be expended in varying degrees on those organs which are in intimate contact with this line traversed by the traumatic agent. The functional disturbances and the pathological changes in the various organs will depend on the physiological functions, weight, texture, etc., of the parts involved, which need not be enumerated here. A blow delivered on the feet, while the lower extremities are extended, will be transmitted to the bones of the pelvis, and then along the spinal column. A somewhat similar result may possibly be produced by a fall on the hands when the arms are extended; however, the force of this blow will be much diminished by reason of the anatomical differences in the parts, particularly the less intimate connection between the bones of the arms and the spinal column, than that which exists between the bones of the lower extremities and this important highway for the transmission of concussive force. It should likewise be remembered that the more concentrated the direct traumatic force, *i. e.*, the smaller the area to which it is applied, the greater will be the amount of concussive force generated while the other factors remain unchanged. Thus a blow covering an area of four square inches delivered directly over any part of the spinal column will generate far more concussive force than it would if spread over the whole posterior region of the body. In fact, in the former case, if the blow was a severe one, functional derangements and pathological lesions might be rationally expected to follow from the concentrated nature of the concussive

force, but in the latter they will be looked for in vain. There is a very marked difference between the concussion in the case of gunshot wounds produced by musket or rifle balls, and that which follows heavy blows or falls—in the former the pathological changes are more circumscribed, while in the latter they may be considered general. Thus a musket ball having found lodgement in the vertebral column, which has in some degree impaired its outer surface without producing any lesion of the osseous tissues within the canal, the spinal cord will be frequently found in an ecchymotic state at a point approximating to the lesion in the spinal column. In connection with this subject, it may be further stated that no single blow,—however great its momentum—delivered on the anterior surface of the thorax or abdomen, could be rationally expected to produce concussion of the spinal cord, since its force would be almost entirely expended on the visceral organs within these cavities. The study of the effects of lightning, and likewise those of electrical currents of both a high and low degree of potency—possess for the surgeon, in connection with the consideration of concussive force, very great interest. The vibratory character of electrical currents is apparently identical with the other forms of concussive force; and, furthermore, it is readily demonstrable that the physiological action, functional disturbances and pathological changes likewise possess essentially the same characteristics. The fact has long been recognized by the ablest authorities that concussion is physiologically indicated by a nervous and circulatory excitation or depression. In accordance with this opinion Verneuil has given the following definition of concussion: "A series of phenomena more or less sudden followed by a mechanical disturbance of the anatomical elements, tissues and organs, characterized by a temporary excitation or a depression of the functions of the parts disturbed, and likewise producing anatomical changes which are generally observed in cases of functional activity or repose." Mechanical concussive force, like lightning strokes and electrical currents, may produce every possible degree of concussion, varying from the slightest functional disturbances, which pass off within a few seconds, to instantaneous death. Further similarity on the effects of these agents is shown by the fact that concussion and even death may be produced by rapidly repeated mechanical blows or a rapid succession of electrical strokes, while a single impulse would be scarcely sufficient to cause even temporary functional disturbance. The pugilist knows that the blows which will promptly render his antagonist unconscious should be delivered on his head. He therefore seizes the head of his enemy and delivers on it in rapid succession blow after blow until his object is accomplished. Experimentation on animals has shown that concussion of the brain may be caused by slight taps delivered on the head in rapid succession with a hammer, etc.

In our consideration of the etiology of concussion of the cerebro-spinal axis we have said little in regard to its causation in the brain. It is probably understood, however, that those agencies which have already been mentioned are the important factors in its production in this organ as well as the other organs of the body. The same general laws pertaining to the etiology of this morbid condition are as applicable here, as elsewhere; consequently a blow delivered on the head will be more efficacious in the production of concussion of the brain than would be the concussive force had it been transmitted to this organ from some other part of the body. Furthermore, the weight of this organ and other anatomical peculiarities of the same, must receive due consideration. In this attempt to describe the symptoms of concussion in the cerebro-spinal axis, we immediately encounter a difficulty arising from the fact that the functions of the organs are materially different; and, consequently, the symptoms observed in connection with a traumatism in the spinal cord, will produce entirely different symptoms from those found when a similar lesion exists in the brain. The remedy for this difficulty is very simple, and only requires that the symptoms be separately noted as they pertain to lesions in the different organs. A much more serious obstacle is found in the combination of all sorts of injuries with those of *pure* concussion, especially those having their origin in fractures, dislocations, sprains, rupture and stretching of ligaments, particularly in the spinal column, and likewise with the concussion in one organ, the symptoms of which are erroneously attributed to this morbid condition in another. In illustration of the above mentioned error, I desire here to call attention to the fact, that hæmaturia is frequently mentioned as a symptom of concussion of the spine, while I have *conclusively shown* by my experiments on animals, that it bears no constant relation to lesion of the cord, but on the contrary, following concussive accidents, *indicates a concussion of the kidney*. Furthermore, visual changes are frequently attributed to concussion of the spine, while as a matter of fact, the lesions on which these changes depend are situated either in the brain or the eye. I am now prepared to assert that the greater part of the organs within the thorax and abdomen are equally as liable to suffer from concussive force as the brain itself; and likewise that concussive accidents are much more frequent in these visceral organs than in the spinal cord. This assertion is based on the fact, that these lesions are entirely analagous to those observed in the brain, merely requiring that the proper allowance be made in these organs for differences

in weight, texture, etc., factors which must be taken into consideration in connection with the study of the lesions of concussion in the brain and spinal cord. Furthermore, every true concussion takes its origin in the same peculiar force. Therefore, if it is desirable to speak of concussion of the brain, spinal cord, etc., why should it not be applied to the lungs, liver, kidneys, etc.? Would it not be absurd to speak of gunshot wounds of the brain and spinal cord, while the term is withheld from analagous lesions caused by the same peculiar force in other parts of the body? There has recently been made *an attempt* to employ the term "*nervous shock*" instead of concussion; but this departure possesses *no advantage* and has already *caused much confusion*. No attempt is here made to deny that certain portions of the nervous system participate in the concussion; although it is self-evident that the functional disturbance and pathological lesions are primarily developed in connection with the *circulatory system*. These preliminary comments are made in preference to any attempt at the mere enumeration of symptoms, which, in order to possess real value, must be fully stated and explained. It should likewise be remembered that there are different degrees of concussions, and these differences are indicated by a corresponding difference in symptoms.

It must now be apparent that the limits of this article compel me to economize space, so far as it can be done without defeating the object for which it was written. Permit me, therefore, once more to call attention to the fact, that concussion always produces either excitation or depression, *i. e.*, functional activity or repose. The former condition possesses practically little interest, if observed immediately after the application of the concussive force, since it is commonly of short duration, and does not require any attempt at treatment. However, there is another form of excitation occasionally observed in severe cases of concussion of the brain, which commonly makes its appearance from twelve to forty-eight hours after the receipt of the injury. This condition is indicated by a full pulse, flushed face, throbbing of the carotids, headache, dry and hot skin, photophobia, noises in the ears, and sometimes marked drowsiness. These symptoms point to the existence of cerebral hyperæmia, which is commonly of short duration; but in some cases it is the prelude to inflammation of the brain. In the severe cases of concussion of the brain or spinal cord, the *prompt appearance of symptoms indicative of depression*, commonly suggests the existence of organic lesion, rather than mere functional disturbances; while, as a general rule, the degree of danger is fairly expressed by the depression. It should, however, be remembered that the symptoms of depression, in order to possess any special value, must pertain especially to the functions which are known to be performed by these organs. Therefore diminished consciousness, although the patient may be aroused sufficiently to answer questions, the pupils contracted or dilated, relaxation of the sphincters, a feeble and irregular pulse, shallow and sighing respirations, a cold, pale and clammy skin—point very clearly to the brain as the seat of the injury, when the symptoms have followed promptly after the application of concussive force. The symptoms following those recorded in the above belong to the reactionary period; the object of this paper does not require that they should be mentioned here. Concussion of the spinal cord is most commonly indicated by the appearance of paralytic symptoms, which frequently involve the lower extremities—especially the motor power, and likewise, in many cases, also the sensory. Therefore, in our experiments made on dogs, our attention was promptly directed to the movements of these animals immediately after the application of the concussive force.

The following facts possess an important bearing on the subject now under our consideration. In a recent summary made from my "Experimental Study of Lesions arising from Severe Concussion," I shall here venture to cite the following: "Paraplegia is a very important indication of a lesion of the spinal cord, and may have its origin either in a disease or traumatism. This morbid condition may be either complete or incomplete, and when due to disease, it is commonly slowly progressive; but if due to a traumatism, it is rapidly manifested, and soon reaches its fullest development. In support of this statement, examine the following facts: The whole number of cases in which pathological changes were found in the cerebro-spinal axis were fifty; the whole number of cases in which any indications of these lesions were observed during the life of these animals were thirty-three, while our record shows that in the last mentioned class there were twenty-three cases of paraplegia."

It will here be observed that there were ten cases in which there had been noted during the lifetime of these animals some indications of a traumatism, but which did not exhibit during that period paraplegic symptoms. It is also worthy of notice that in every instance these paraplegic symptoms were observed immediately after the application of the concussive force, and furthermore, that in all cases of complete paraplegia there was not a single case which subsequently improved. In the large majority of cases of incomplete paraplegia there was commonly some improvement observed during the first three days, but in a few instances the paraplegic symptoms became more marked during the first twenty-four hours; however, even these cases soon showed signs of improvement. It is not claimed

that even the immediate appearance of paralytic symptoms after the application of concussive force, in all cases establishes the existence of pathological lesions in the spinal cord. I am strongly impressed with the idea that an injury of the peripheral nerves may be followed by temporary and commonly local paralysis. A certain degree of importance should be attached to the existence of either anæsthesia or hyperæsthesia in all cases where lesions of the spinal cord are suspected. The existence or absence of pain in these cases—especially true concussion of the spinal cord—possesses very little interest for the diagnostician. In fact, the existence of pain and soreness ought probably to be looked on as having their origin in a contusion, sprain or wrench, involving the vertebral ligaments, muscles, etc., rather than indicating lesions of the cord. Having now presented a few of the characteristic symptoms of true concussion of the brain, and likewise of the spinal cord, I desire to add in this connection, that it is certainly very unfortunate for the science of surgery, that hitherto it has been the custom of nearly all authors, writing on what they have unfortunately designated as "concussion," to group together half a dozen or more traumatic conditions, differing *radically from each other* in their *etiology, semeiology* and pathology. It requires no prophet to *assert positively* that so long as this grouping is continued there will be a want of clearness in all these articles—that theory will be frequently introduced in the place of scientific facts, that clinical observation will continue to mislead the profession, that good-natured authors, believing that all their predecessors in writing on this subject have told a little truth, will still further add to the existing confusion in their attempts at compounding these incompatible ideas. Let me ask what would be the inevitable result, if medical authors should group together under the unfortunate cognomen of "Smith's disease" scarlatina, diphtheria, rubeola, roseola, variola, typhus fever, etc.? However, this combination is no more objectionable than that grouped under the name of "railway spine," which is so frequently employed by many of our surgical authors even at the present time. However, the dawn of a new light may be approaching, since Dr. John A. Lidell, in writing on "Injuries of the Back, Including those of the Spinal Column, Spinal Membrane, and the Spinal Cord," states that "the traumatic lesions of the back naturally arrange themselves in three groups, as follows:

1. Injuries of the integuments and muscles, or soft parts generally.
2. Injuries of the vertebral column.
3. Injuries of the spinal membranes, spinal cord and spinal nerves.[1]

It must be apparent to any one that this classification presents many important advantages over that which is so commonly employed. Another serious source of confusion has arisen from the fact, that the term concussion, in former times, was restricted in its application to the brain—although analagous pathological lesions were produced by the same force in nearly all the organs of the body.

Furthermore, concussion was badly defined by the old authors; since the term was used to indicate a condition induced by a more or less violent shaking of the brain, whereby serious symptoms were produced without lesions of the structures.

Recent experiments on animals and a careful study of this subject have entirely failed to support their statements in regard to the *non*-existence of lesions after concussive accidents in the brain and spinal cord. The results of my experiments were very conclusive in regard to the existence of these lesions. There were fifty cases in which pathological changes were observed in the cerebro-spinal axis, but only thirty-three of these cases showed any symptoms during life of injury of this centre; it will therefore be readily seen that in seventeen cases, although pathological lesions existed, they were not made apparent by symptoms which could be recognized on the animals. It is likewise important to state in this connection, that there was not a single case observed during all of our experiments in which we even suspected the existence of concussion of the cerebro spinal axis where we failed to discover pathological lesions by our subsequent examination—*post-mortem* or *microscopical*. These pathological lesions, in true concussions, are certainly unique in character and nearly or quite pathognomonic in their signification. The only lesions which bear semblance to the pathological changes of concussion, are those arising from contusions, and these are localized, and not distributed generally throughout the organ, which is commonly the case in the former morbid condition. However, there is found an exception to these rules in the case of concussion following gunshot wounds, in which the injury is commonly localized and resembles more or less closely the ecchymotic appearance arising from contusions. The functional disturbances and the pathological lesions are clearly shown in my experiments, to have had their origin in the vaso-motor system. In order to illustrate the pathological changes in the spinal cord which have been observed to follow in a mixed or complicated case of concussion of this organ, I will here cite the report of an autopsy. etc.,[2] made on the body of a coal-porter who died thirty-four hours after the accident.

[1] The International Encyclopædia of Surgery, Vol. iv, p. 668. Edited by John Ashhurst, Jr., M.D. New York: Wm. Wood & Co. 1884.

[2] International Encyclopædia of Surgery, Vol. iv, p. 790 et seq. Edited by John Ashhurst, Jr., M.D., New York. Wm. Wood & Co. 1884.

Autopsy.—There was no external trace of injury. The membranes of the cord were healthy. The substance of the cord was contused opposite the fourth and fifth cervical vertebræ. On section, there was found ecchymosis of the posterior horns of gray matter on the left side, and of the adjacent part of the lateral and posterior columns. There were also limited spots of ecchymoses on the right side, one in the right posterior column, and one in the right anterior horn of gray matter. The gray substance generally was hyperæmic. On removing the spinal cord and membranes, nothing abnormal was discovered in the vertebræ until the posterior ligament had been dissected off, when it was seen that the body of the fourth was separated from that of the fifth, and the left articular process of the fourth had been chipped off. Dr. John A. Lidell, who reports this autopsy, comments on it as follows: "The essential features of this instructive case are as follows: 1. The cord substance was injured by concussion, and not by any displacement of the parts; 2. the injury was attended by a number of minute extravasations of blood (ecchymoses) in the gray substance; 3. there were anæsthesia and loss of motion in both lower extremities and in the left arm; 4. there was paralysis of the sphincter ani and sphincter vesicæ, which denoted that the reflex motor apparatus was also paralyzed; 5. the anæsthesia passed away in the course of some hours, the return of sensibility being noted first in the parts most distant from the injury; 6. hyperæsthesia appeared synchronously with the reaction from "shock," and steadily increased in severity; 7. hyperæmia of the gray substance was found as well as ecchymosis. It should be remarked that the hyperæsthesia was more severe in the right arm than elsewhere, and this part had not at any time been paralyzed." This case was reported by Dr. Lidell as a pure or uncomplicated one of spinal concussion, but I am compelled to question the correctness of the report in this particular, and direct attention to the ruptured ligament, which it seems to me may have permitted a partial dislocation to have taken place—with contusion of the cord—the vertebræ afterwards having been restored to their proper position by the natural resiliency of the parts. The symptoms of paralysis were certainly more marked than they are usually in cases of pure, uncomplicated concussion of the spinal cord. The following microscopical report conveys a very clear idea of the pathological lesions observed in our experiments on animals in the cerebro-spinal axis when there were no complications in this centre.[3] "Brain intensely hyperæmic otherwise normal. Every portion of the cord intensely hyperæmic. There were punctate hæmorrhages in the dorsal and cervical regions of the spinal cord, in both the anterior and posterior horns, also in the middle commissure." The striking analogy existing between the pathological lesions in cases of death caused by electricity and the other cases of concussion, may be probably better illustrated by giving a condensation of the report of the autopsy made by Dr. Carlos F. McDonald on the body of William Kemmler, after execution by electricity, since this examination has been more carefully detailed than any of the others. The others, however, entirely agree with McDonald's so far as given. McDonald's report is as follows: "Rigor mortis marked. On incising the skin over the sternum, the blood which escaped was unusually dark and fluid, remained so on exposure. Lungs: tardieu spots were noticed on the posterior border of the lower lobe of the left lung, so also in the middle lobe of the right lung. Heart: valves and substance normal, ventricles empty. Liver: blood from cut surface of dark crimson hue. Gall bladder: distended with bile. Spleen: normal. Kidneys: both markedly congested. Brain: *capillary hæmorrhages* were noted in the floor of the fourth ventricle, also in the third ventricle and the anterior portion of the lateral ventricle. The perivascular spaces seemed to be distended with serum and blood." Dr. Spizka's report of the preliminary microscopical examination is as follows: "The brain, spinal cord and peripheral nerves appeared strictly healthy in every part examined, except in the area corresponding to the discolored (anæmic through the contraction of the vascular channels) area of the Rolandic and pre-Rolandic regions, the ventricular surfaces, the pons and the medulla oblongata. The latter, which had been the seat of post-mortem preservation of temperature approaching that of the normal human body, were distinctly softer than the observer has ever been accustomed to find these parts in autopsies on persons of Kemmler's age and performed so soon after death. The hæmorrhagic spots in the fourth ventricle, which were strongly marked, were not accompanied by signs of parenchymatous rupture of large blood vessels. Hence they may be regarded as having the same significance as the "taches de tardieu" found on the surfaces of the organs, notably the heart and lungs. The peculiar softened vesicular zone of tissue underlying the outermost layer of the cerebral cortex is noteworthy, as "the destruction line" runs parallel to the free surface of the brain and does not dip with the sulci. Examination of the fresh specimen revealed the existence of vacuoles (probably gas bubbles) in the ganglion cells and in the parenchyma of the "destruction line." From the fact that no hæmorrhages had occurred in this softened area it is a just inference that it was produced after life had become entirely extinct, for the continuance of a

[3] An Experimental Study of Lesions arising from Severe Concussion, p. 22 et seq. by B. A. Watson, M.D., Philadelphia, Pa. P. Blakiston, Son & Co. 1890.

blood circulation in a softened brain area is incompatible with the bloodless appearance, already noted, and the absence of capillary hæmorrhages in this very district while they were present in those remote from the site of the electrode."

In order to approach the consideration of *malingering*, it is necessary to devote some attention to the traumatic conditions which frequently complicate concussion in the cerebro-spinal axis, since the majority of authors still include these morbid conditions under the head of "spinal concussion," "railway spine," etc. Fractures and dislocations of the vertebræ require little attention, at the present time, since they are easily diagnosed. The only exception to this rule will be found in those cases where there is a complete absence of deformity, which may be the case where the fracture consists in chipping off a portion of the articular vertebral surface, etc., or in an incomplete dislocation of a vertebra, in which the natural resiliency of the ligaments and muscles has restored the symmetry of the parts. In these cases, it is thought that the careful and observing surgeon will not be compelled to remain long in doubt as to whether the patient before him is a malingerer, or suffering from a real traumatic injury; since the prompt appearance of objective symptoms will certainly be largely dependent on the locality of the injury, while their degree of severity will depend very much upon the extent and character of the traumatism. There now remains for our consideration in connection with this subject, contusions, sprains, twists and wrenches of the back, which are entitled to a more thorough analysis than can be given them in this article, on account of their medico-legal bearings, in litigated cases. The study of these morbid conditions, it should be remembered, will be greatly simplified by bearing in mind the fact that their symptoms, the primary and secondary effects, are entirely analogous to injuries of the same character in other parts of the body. It is claimed that the spinal column and the bones which connect directly with it, are provided with ninety-nine articulations. The symptoms which characterize the morbid conditions now under consideration are pain, swelling, tenderness under pressure and occasional ecchymoses. The existence of the symptoms will be limited to the area involved in the traumatism, while the degree of severity will depend on the intensity of the injuries. There may be likewise, in some cases, constitutional disturbances which will aid in establishing the existence of a morbid condition. The ecchymoses and swelling are objective symptoms, and consequently entitled to due consideration, while the pain, stiffness and tenderness under pressure may require confirmation. The verification of the patient's statements on these points, and frequently on others—especially questions involving the existence of paralysis—might be definitely put at rest by the proper use of an anæsthetic, which ought to be frequently employed in medico-legal cases. The general surgeon no longer hesitates to employ this agent in his private and public practice for diagnostic purposes, and why should it not be thus employed for the purpose of securing justice in our courts?

Drunkenness and syncope may make the diagnosis more difficult in certain cases of concussive accidents, whether it be pure or complicated concussion; but these factors are of short duration, and therefore cannot continue long to embarrass the surgeon. Having presented our views on the chief factors involved in the diagnosis of the so-called "railway spine," therefore we are prepared to devote a few minutes to the malingerer. It is unfortunately too frequently the case that a surgeon commences his examination, in medico-legal contests, after *having fully formed an opinion*, or at least a bias or prejudice. This, in many cases—in fact, almost universally—arises from the want of an analytical mind, and likewise the want of any carefully arranged system of examination. These are very serious defects in the expert witness and, when fully demonstrated, should disqualify him to give testimony. There is another serious defect, frequently observed in the members of our profession, which sometimes has its origin in laziness, although occasionally in an inordinate greed—where the physician has been *accustomed all his life* to give an opinion to a patient without either an examination or thought. It will be perceived that I have not yet reached the case of the malingerer; but I have thus far merely paid my respects to those who aid and assist the malingerer. The malingerer is certainly entitled to a careful and thorough examination, and each surgeon employed in the case ought to proceed in his examination with the same degree of care and caution that the most conscientious chemist would exercise, when required to make a chemical analysis in the interest of justice. It therefore becomes highly important to learn the true history of the litigant, and likewise that of his father, mother, brothers and sisters. All these matters have a special bearing on the case. It will be readily admitted that any person who has established a good character for truthfulness and honesty ought not to be classed with a mere adventurer. In the examination of all the factors involved in these cases of so-called "railway spines," the fact should never be lost sight of that *correct scientific opinions can only be reached by a systematic, methodical and painstaking investigation.*

Let us here present a brief *résumé* of some of the points which have been more or less considered in this paper.

1. The term concussion, as used by those who

first employed it, was erroneously defined, and unfortunately restricted in its application to the brain. These errors had their origin in a deficient knowledge of the pathological lesions engendered by concussive force.

2. Concussion is a more or less violent shaking or agitation of various organs in the body, producing functional derangements dependent on vaso-motor changes and well-defined pathological lesions.

3. Concussion may be either general or special, general when several organs are involved at the same time, or special when the entire concussive force is expended on a single organ.

4. The symptoms arising from concussion will chiefly depend on the extent of the pathological lesions and the functions of the organs.

5. The frequency with which concussion will occur in any particular organ will depend on the point to which the concussive force is applied, the relative weight of the organ, the character of its texture, and the protection afforded by its anatomical surroundings.

6. The fifth statement supplies the explanation of the comparatively frequent occurrence of concussion of the brain, lungs, liver and kidneys to that of the spinal cord.

7. Concussion of the brain and spinal cord is always attended with immediate symptoms.

8. Concussion of the brain or spinal cord without immediate symptoms is a mere hypothesis—a myth—and has no real existence.

9. There is no pathognomonic symptom of concussion in any organ of the body; but a thorough, systematic, methodical examination by a skilled surgeon will secure a correct diagnosis.

Finally, I desire to reiterate the fifth conclusion expressed by Dr. Henry Hollingsworth Smith, in a paper which he read before the Surgical Section of the American Medical Association in 1889, which is as follows: "No physician should go into court and swear that a plaintiff has had a concussion of the spinal cord, or of its nerves, unless he has proved the disturbance of the normal functions of the cord, as shown in sensation or motion, or both, and that the symptoms appeared soon after the injury."

AN EARLY SYMPTOM OF WHOOPING-COUGH.—Dr. Heguin, of Tourteron, affirms (*Union Méd. du Nord-Est*), that photophobia with dilatation of the pupil is a useful diagnostic symptom of whooping-cough in the early stage, before the cough has become characteristic. He cites three cases in support of this position; two of the patients were children and one an adult, and in all of them the symptom referred to preceded any other manifestation of the disease.

A CONSIDERATION OF TRAUMATIC LESIONS OF THE SPINE RESULTING FROM RAILROAD AND OTHER INJURIES—THEIR ETIOLOGY, PATHOLOGY AND DIAGNOSIS.

Read before the Section of Medical Jurisprudence and Neurology, at the Forty-second Annual Meeting of the American Medical Association, held at Washington, D. C., May, 1891.

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Since the enormous extension of the railroad system—surface, submarine and elevated—wherein steam is utilized as a motor, the attention of surgeons and the profession has been attracted to certain special features, which commonly attend or subsequently follow accidents, sustained by individuals on cars in motion, on iron rails.

Many have maintained that injuries resulting from railway disasters, possess characteristic and positive lesions, which are peculiar to themselves, in symptomatology, pathology and termination. While, on the contrary, there are not a few, who take an opposite view and claim identity of analogy, between them and other disorganizations of tissue, in which the collision of heavy, moving bodies has been the direct cause, or in which similar physical agencies, but devoid of steam propulsion, have come into action.

In the meantime, as if to give stability and warrant to the former allegation, certain practitioners in different sections of the country have organized, and now the profession is threatened with another specialty; we have the Society of Railway Surgeons. We have in several of our large cities and railroad centers, hospitals owned and controlled by railway corporations, or the medical officers in the immediate employ of roads. These are maintained by the companies for the purpose of treating those of their employes injured while in their service. With those hospitals owned and controlled by individual surgeons or colleges, services are usually rendered by contract with the railroad corporations, much to their advantage; for while professional aid is procured at a minimum rate, the companies are also protected, in having their maimed or injured under such supervision, as will effectually guard against malingering; and, besides, should a civil suit arise, the surgeon is drafted into their service.

So far we have no special section at the meetings of the American Medical Association, for railway surgeons. Is it necessary to further subdivide the field of surgery? While all general surgeons are presumed to possess ample qualifications to serve their country in the field, in times of war, yet France, Germany and England have each, supplementary medical institutions to equip medical graduates for military duty.

With our rapidly extending lines of railroads, which radiate and ramify in every direction, on which more than one hundred thousand men are employed and millions of travelers ride, we can easily apprehend that the number injured annually must be very large. Do their injuries or lesions differ in their dynamic essentials, their anatomical characters or pathological phenomena, from those sustained by other causes in civil life? Do those injuries occasioned by collisions on railroads or otherwise in connection with travel or employment on them, constitute a certain and separate category of features, which are characteristic and peculiar, with regard to their local destruction and ultimate termination, and demand for their successful treatment the superintendence of one of special skill and extended experience? I think the majority will answer in the negative.

ETIOLOGY OF SPINAL INJURIES ARISING FROM RAILWAY ACCIDENT AND OTHER CAUSES.

Conditions of the spine arising from trauma in a general way, may be resolved into two divisions, viz., those in which there are distinct and definite lesions, and those in which there are functional disturbances, without any visible alteration of structure. With the former chiefly are we concerned, on the present occasion.

It has been seen that many regard railroad injuries of every description as possessing characteristic features. Everyone, who has had any hospital service, into which are entered casualty cases from railroads, has noticed that the destruction of the soft parts is very much more than is seen from other injuries, so that when amputation becomes necessary, and we trim sparingly, in a few days after, the flaps are gangrenous and we must go further up; or if we secure primary union not infrequently we will see an insidious osteo-myelitis arising; requiring a later and more extensive section of bone. It is this class of cases, too, in which we all must often notice that fearful phenomenon, of which so much is seen and dreaded by military surgeons—secondary shock.

It is important, therefore, before we can make a rational study of this question, that we ask ourselves, what a serious railway accident really is, which should give it those fearful attributes of destruction, or why they should be more common now, than formerly.

In considering the physics of the study, we must have a correct notion of inertia, momentum, velocity, power, resistance, motion and direction. A body at rest, is struck by a flying missile, the penetrating power of which is in direct proportion to its initial velocity. In studying railway injuries, or rather those occasioned by collisions on railways, we will discover the same identical laws in effect, as in the case of a flying missile, but the picture is reversed; the human being is then in a passive, inert state, wholly beyond his own control at the moment of collision.

In the practical flight of an express train down an inclined plane, that ponderous mass of metal, the engine, and the passenger coaches are literally shot through space. In this state of motion, in making a sharp curve, or otherwise, the wheels leaving the rails, this train and its human freight, are sent onward, until the initial motion imparted by the locomotive and by increased gravity, has spent itself on the parts, in a state of inertia at the instant of collision. What gives to railway rolling stock its great destructive properties are its weight and speed. The car trucks to support their burdens, with safety, must be heavily constructed; besides, the more weighty their wheels, the more regular and easy their motion. To supply the demands of travel for fast mail and freight transportation the moving rate of speed has been very greatly augmented, hence danger, in the event of an accident, is proportionally increased.

We have then, in the modern moving train, propelled by steam, two factors indispensable for force, viz., weight and speed, which are always brought to bear on the body, in cases of sudden and violent concussions, when it in whole or part, is crushed, stretched or twisted. In many respects there is no little analogy between the spine and a train of cars. We may suppose each vertebra a car; the interlying cartilage a buffer; the ligaments connecting links and the head, the massive machine. In the center of all the *medulla cerebralis et spinalis*, the precious freight, the passengers.

Of all the traumatic lesions which have definite and presumptive pathological lesions, arising in consequence of railway accident, or other mishaps, there are none, which have given rise to so much investigation, study, experimentation and vehement controversy, as those arising from railway accident, and which occupy the cerebro-spinal axis.

Eric Erichsen was among the first who contributed anything in a methodical way on the subject of spinal lesions attributable to railway casualties. In America Dr. B. A. Watson, of New Jersey, conducted a very extended series of experiments on the lower animal (the dog) with a view of further clearing up mooted pathological questions and endeavoring to connect symptoms with pathological changes.

Since the appearance of Erichsen's lectures we have had such a pathological entity as the "railroad spine." For he taught that the clinical features, morbid anatomy and history of certain forms of spinal injury, caused by railway accident, were unique, definite and characteristic.[1]

[1] Watson, An Experimental Study of Traumatic Lesion of the Spine

Watson, on the other hand, after his painstaking, laborious and exhaustive investigation, concluded, to quote his own language, that "concussive accidents never produce pathological changes in the spinal cord, except when great force has been applied to the spinal column, and these cases generally, if not always, are complicated with a fracture, rupture and stretching of the ligaments, or severe lesions, in other parts of the body, which terminate quickly in death."

Erichsen ventured to affirm that neuroses of every phase and degree, from profound melancholia, dementia or paralysis, might arise, either immediately after the railway collision, or at a remote date. His observations are mainly limited to the elements of the cord and brain with the meninges, and he takes but little notice of the part which the enveloping tissue play, either in association or as independent factors. The muscles, tendons, ligaments, extravascular supply and peripheral nerves are wholly ignored, and he looks solely for pathological changes to support his theory in the medulla and meninges. Watson's experiments having been conducted on the dog dropped through a chute, we must compare the striking difference between them and man, with respect to their physical conformation and mental attitude, before we can properly estimate the clinical application of these experiments. In one the spine is nearly perpendicular, and we must not overlook the element of fear. In the other, the spine is horizontal and has four supports instead of two, besides psychological influence is wanting. Man's head is very heavy in proportion to his size. The quality and direction of concussive force possessing but little analogy with such as is inflicted in railway accidents, we cannot unqualifiedly apply those experiments in the lesions under consideration.

Although the views of both distinguished authorities here cited are widely divergent and antagonistic in many respects, though, strange as it may appear, in one direction, at least, they evidently agree, for neither appears to attach much, if any, importance to the direful consequences to the integrity of the spine, which may follow injury of the soft parts independent of implication of the cord itself. Neither author has been able to supply anything but very scant pathological data from post-mortem examination on the human body, where death has been directly or indirectly caused by spinal injury.

In this connection an effort will be made to demonstrate by anatomical analysis and pathological observation that, quite independent of alleged morbid states which are manifested by clinical symptoms, we may and frequently do find the motor functions of the spine temporarily impaired or lost by lesions which in no way directly implicate the cord itself.

To proceed intelligently with the separative causative factors, we must have a clear comprehension of the varied structures which we have to deal with, their relations and functions. Among the laity, and even medical circles, sometimes a most confused notion would seem to prevail with regard to injuries in the rachidian region.

What is the spine? We will be told that so and so met with an accident and has seriously injured his "spine." Lay people have a vague but singularly correct impression, nevertheless, that when paralysis immediately follows injury, the "back is broken." With our profession, the general opinion of a serious injury of the spine always implies that the cord has participated in the lesion. Neither view is correct, for we may have complete paraplegia without a broken back, and vice versa. And we may too see individuals invalided for life when the great nerve cylinder and bony arches have entirely escaped.

The spinal column in man is maintained in the upright position by a powerful set of muscles, with an accessory set of stays, the numerous ligaments which, though permitting varied movements, firmly retain the vertebræ in position. Besides those osseous spurs given off by each vertebræ, serve as levers and are so intimately interlocked that even in the dead body they are detached from each other with difficulty.

If the vertebral column be denuded of its muscles and traction force is applied in opposite directions, the arches or transverse processes will give way often before the ligaments. As the dorsal vertebræ are firmly braced on either side by the ribs, the spine, in the event of a traumatism, will yield less in this situation, but as the lumbar region is reached lateral support is wanting, and on this the whole weight of the head and trunk is borne.

Speaking in a general way, we may say that among the manifold and varied purposes which the rachidian column serves, the most obvious and important are: 1. To form the posterior boundaries of four cavities, if we include the sacrum. 2. To support the head. 3. To carry all viscera and structures lying beneath the under surface of the cranium. 4. To provide lodgement and protection to the spinal cord.

Its weakest and most superficial segment is its most mobile; its middle the most fixed, and yet—to employ a paradox—is in constant motion, through costal action on either side. The lumbar region is the most powerful and is the center of flexion between the trunk and pelvis.

It may be well in this connection, while considering the powerful and complicated structure of the spine, to remember that that organ within the tubular canal, the cords, is but fifteen inches long and weighs but an ounce and a half; that it floats in a water bed that protects it from pressure and ordinary jars. The cervical or lumbar

segments, in the event of great and concentrated violence, permits of a distinct, lateral swaying motion, so that the momentum of force may be spent rather on the ligamentous, osseous or muscular parts, than be transmitted to the cord or brain.

Besides either extremities of the spinal column where force may be applied, either in the way of traction or compression, it may be also brought to bear from behind, or latterally. Violence, to reach the cord interiorly, must first encounter the viscera, or disorganize the spinous bodies, which would be impossible without immediate destruction to life.

Of the different regions, probably none can sustain a crush or fall with as much impunity as the dorsal. The osseous structures of the spine, here lie below the posterior costal curves and force is diffused through the elastic contents of the thorax, or one or more ribs are fractured. The same degree of violence inflicted on the cervical region, suddenly and unexpectedly, would have mortal consequences. But, when one has even a second's notice, he instinctively shortens his neck, obliterates it, as it were, by crowding it into the thorax, by raising his shoulders up to the ears, depressing the chin to the sternum and the occiput to the *vertebræ prominens*.

Accordingly we find the lumbar region the most vulnerable; for we may regard the segment as the centre of a hinge-joint, and, as might be expected, is oftenest found the part which suffers in these spinal injuries, from which a patient may, for a time, survive. But the lumbar segment has a powerful and compact development; hence, simple violence, to compromise its delicate contents, must be direct and great, so that, as Watson discovered in his unique experiments on the dog, the lesion of the cord often, in itself, is of but minor importance, in comparison to the rupture or laceration of an organ vital to life.

It would be rational to assume that, in the vast majority of cases in which force operated in the cervical or dorsal regions with sufficient concussion to fracture bone, death would seem an almost inevitable consequence. In eight cases which have come under my observation, in which the brunt was borne by the lumbar spine, six died, one in six hours, two in a week, and one lived three weeks. One recovered completely, and the other left the hospital, paraplegic. There was paralysis in all these cases in the beginning. Three of them were the result of railroad accident. In all the cases, the kidney sustained associate lesions.

As far as the etiology of traumatic spinal maladies goes, my experience is mainly in harmony with the views promulgated by Dr. B. A. Watson, of New Jersey, in his experimental work on the spine, viz.: that in traumatisms of the spine, attended with paralysis, we will *always* find pathological lesions involving it, of a definite and positive description.

Prof. Erichsen, in his lecture on spinal concussion, details at considerable length a large number of cases, in which symptoms of paralysis at varying intervals after *railroad* accidents appeared. In some of these cases, there were complications of brain symptoms, with affections of the nerves of special sense. In many there were disorders of vision or hearing, melancholia, hallucinations, neuralgias, loss of memory, unsteady gait in walking, numbness and hyperæsthesia, and other ailments affecting the nutrition of the body.

In none of those cases were pathological changes present *which could be proven*, but it was assumed that anæmia of the cord existed, or that there were either chronic meningitis or myelitis.

Having seen myself a considerable number of cases of injury to the back, arising from railroad injuries, in none have I ever encountered these sequelæ. And, with proper deference to the distinguished author, yet I am convinced that his premises are unsound and untenable. And I am satisfied that his conclusions, though ingeniously constructed, will not meet with favor among those of extensive experience in the treatment of railroad injuries, or serious traumatisms of the spine.

There are, however, other serious lesions which may attend injury of the spine, which have been described by no writer in modern times, except Olliver.[1] I refer to those which are limited to the peripheral nerves, muscles, tendons, ligaments, vessels or bone; which are attributable to strain, twist, pressure, laceration or contusion, and give rise to extravasation of blood, to inflammatory exudates, synovitis, periostitis, abscess, amyotrophic changes, myopathies, thrombosis, embolism, phlebitis, cellulitis or anchylosis, and which may and often do, in early childhood, or even in middle life, be the starting-point of various organic maladies.

Extrinsic spinal injuries are very common. The vascular system supplying and maintaining the nutrition of the cord; its coverings, the meninges; the rachidean structures, osseous, ligamentous and muscular, is peculiar in its arrangement, although in many respects it is similar to the cranio-cephalic, in that there is a free intercommunication between the peripheral and the deep vessels. Hence, the explanation how inflammatory conditions are propagated from the superincumbent cellular tissues to the synovial investment of the vertebral joints, or to the elements of the cord, when the process is in relation to the cervical region.

I have on three occasions met with cases of spinal meningitis, in which the primary injury was first borne on the nates, or over the shoulders. A case of this description I saw with Dr. W. B. Fisher two years ago, in the town of Yonkers, N. Y. The patient was a young lady who, while

[1] Traité Maladies des Spine, ed. 1, p. 207.

on roller skates, fell on her left nates and side. She was very sore, over the seat of injury, for two or three days, the parts being swollen and tender. Soothing applications were applied, and she was confined to bed.

As the fulness and pain commenced to subside over the gluteal region, she began to complain of "pins and needles" (formication) in the soles of her feet. This was followed by numbness, and on the seventh day after injury she was completely paraplegic. On the tenth day she died, of typical meningitis of the spinal cord.

My two other cases were seen in hospitals. In one, spinal meningitis developed six days after the patient was violently clubbed by a police officer. On the second day after his castigation, his mid-dorsal region was one mass of welts and bruises. The skin over the injured area was mottled, hard and lumpy. With him, paralysis was confined to the lower extremities, but there was much more convulsive spasm of the extremities than in the preceding. His case was remarkable with respect to its termination, as he recovered from the meningitis, so that he was able to leave the Workhouse Hospital, on crutches, *three months after injury*, the paralysis not having wholly disappeared. No doubt a thickening sclerosed condition of the neurilemma of the nerve roots lingered, which might account for the nerve symptoms.

In my third case, the patient was injured by being knocked down by a passing team. Two ribs were fractured, but she was able to get on her feet, and walk home without assistance.

She was brought to the hospital on the fourth day, with symptoms of incipient spinal meningitis. The disease made rapid progress, quickly extending into the cervical section. She died on the fourth day after admission into hospital.

On post-mortem examination we found, on the left side, the sixth and seventh ribs fractured, close to the transverse processes. A large, diffuse extravasate of blood was discovered under the long, broad bands of the serratus magnus muscle, and the connective tissue on the right side. In places, it was liquid, in others partly organized, but for a very considerable radius about, the tissues were deeply red-stained by the escaping hæmatin.

The tendinous and ligamentous structures in the vicinity of the sixth and seventh cervical vertebræ were softened and thickened. On entering the spinal canal, no hæmorrhage was met with. The dura mater was greatly distended with a turbid, flocculent serum. Between the arachnoid and pia mater, throughout the cervical area, as far as the atlas, a fibro-plastic exudate was seen, which insinuated itself along the horizontal septa into the lateral sulci of columns. The medullary substance of the cord was softened in the centre, and was everywhere dotted with minute ecchymoses.

Besides those lesions which involve the cord secondarily, and have reference to propagation of irritation or infection, through the nerves, vascular channels or lymphatics, we have another important group arising from muscle or ligament strain, from contusion of the peripheral nerves, which regulate movement and nutrition of all the overlying structures, from the integuments inwards, from hæmorrhage, cellulitis, periostitis, synovitis, arthritis, fatty degeneration of muscle, limitation of muscular action or anchylosis. The etiological factors in all the above were primarily concussive force, and conditions dependent on vital phenomena.

Sprains are commonly understood as trivial wrenches or twists of an articulation, attended with pain, swelling, and ecchymosis of the integuments. Authors give them little notice. But over-strain or violent sprain of a joint, or series of joints, attended with extravasation of blood into the articulation, with laceration of muscle or ligament, may be the starting-point of very grave organic changes, particularly in the young, or those inheriting a feeble constitution. In spinal injuries, chronic, multiple synovitis, periostitis, softening, wasting and atrophy of the muscles, with weakening, stretching or displacement of the ligaments, are a few of the sequelæ, in aggravated cases. I have met with a case, in which a violent twist at the ankle-joint originated a diffusive osteo-myelitis which ultimately necessitated amputation above the joint.

We may have, in one or more joints of the spinal column, the same precise pathological conditions as obtain in the extremity; but as the spinal articulations are all deeply lodged, they more often escape. And, if they should be the seat of sprain, it must, during life, be rather inferred than proven.

Nevertheless, when a person comes under our observation, who is injured in the back, who has a febrile pulse and a high temperature, with a local fulness and hardness over a localized area of the spine, but in whom sensation and motion are perfect, there can be no doubt as to superficial or extrinsic nature of the lesions.

The most frequent source of injury to the ligamentous and muscular structures, is by indirect force at either terminus of the column. The dorsal and lumbar regions suffer most from this form of violence. One falls from a considerable height, or is hurled a short distance, striking on his nates or hip. The spine is bent backwards, forwards, or laterally, the inertia of the head, shoulders and trunk is mostly spent on the lumbar vertebræ.

Not infrequently, however, serious strains are induced by concussive force coming from an opposite direction; as when one is precipitated in such a direction that the point of impact is on the shoulder and side of the head, when the whole

weight of the lower trunk and extremities impinges, with great momentum, on the upper mobile, lumbar segment. These accidents, involving only the extrinsic structures of the spine, then, well deserve a careful study, for it cannot be denied that, when of a severe nature, the original pristine strength of the spine is forever lost, and locomotion will be always thereafter difficult and painful. If they occur in a maiden, she can never properly fulfil the duties of matrimony with safety; nor, in fact, perform any sort of labor requiring considerable effort.

A consideration of those infirmities of the spine, exclusive of the neuroses of the cord, following spinal injuries, opens the way for a new line of study, which may be cultivated with great interest to the surgeon and practitioner, and advantage to the crippled.

I have met with a few cases of spinal injuries in adults in which there followed absolute and permanent impairment of power, while the cord remained free.

The first case I saw with Dr. Sheahan, of this city, in which the patient, a young woman, was suffering from the effects of a fall into a deep trench on a dark night. She thought she struck on her shoulder but was not positive. She was confined to bed for more than six months and was unable to sit in the upright position for more than a year. The lumbo-dorsal muscles were markedly atrophied on both sides and the spinous processes of the lumbar vertebræ projected out so that the tips could be easily counted. There was no neurotic condition of any description. Her infirmity was local and was confined to the muscular and ligamentous structures alone. She was, when I saw her, wearing a very heavy gypsum jacket. Without it she was almost powerless to move. Her general condition was good, with a fair muscular development. There had never been any question in this case, or the two others which will be recorded, as suits for damages. It is now two years since I saw her, and her physician writes me that though she makes a living with the needle, yet she is as weak and helpless in the back as ever.

The second case was also in a woman. She was nineteen years old, and was injured while descending the steps from an elevated railroad station. She was near the surface when she slipped and fell with great violence on her back. Being unable to stand or walk, she was conveyed home in an ambulance, where she lay in bed four months. She was now examined by the railroad surgeon, who was inclined to regard her troubles as trivial, inasmuch as there was no central implication of the cord. At this time she was admitted in the hospital. On examination in the lower lumbar region it was evident that an abscess was forming close to the inner border of the quadratus lumborem muscle. On freely incising it a fistulous tract was discovered extending down to the transverse processes of the second and fourth lumbar vertebræ. By enlarging the wound, we came down on those processes of bone which were necrosed, and with the gougers cut them away. There was a considerable area of diseased tissues along the line of the vinus, which was scooped away. The incision healed by granulation, beginning at the bottom, but it was more than three months before it closed in entirely. She now occupies a position in a dry goods store, but there remains a rigidity of the muscles of the back, which greatly limits the normal stooping movement and prevents her from occupying her former position.

My third case of permanent impairment of function following severe injury of the back, was a carpenter, who while in a stooping position was struck over the lumbar region by a falling piece of timber. I saw him shortly after he was injured. There was no palsy, but his spine was rigidly fixed and over the seat of injury there was great pain. He passed blood in his urine, both as coagula and in the fluid state, in such quantities as to threaten fatal anæmia. By the aid of refrigerant drinks and cold applications on the nephritic regions it gradually lessened and in a few days completely ceased. This man had a slow and painful convalescence. For many months he could not maintain the trunk on the femoræ in sitting or walking, without making a lumbar support, and for three years he was an invalid. For a long time there was a marked and considerable fullness over the left kidney, whether attributable to hæmorrhage beneath the capsule into the parenchyma or stenosis of the ureter with hydronephrosis, we are unable to say. It, however, gradually diminished in size and ultimately disappeared.

These three cases constitute all the lesions of an extrinsic character clearly attributable to overstrain or contusion of the spine, in which permanent disability in varying degrees have followed injury, that I have seen.

In the treatises and brochures of Abercrombie, Guthrie, Brodie, Cooper, Ollivier, Chappioneare, Duplay and Richet many cases of this character are mentioned but not fully described.

In analyzing the phenomena of those painful neuroses over the long axis of the rachidian plane, we cannot forego at least a cursory examination of the nerve supply, of the meninges, the bony framework of support, the soft parts and integuments.

The dura-mater is supplied mainly by extremely delicate prolongations inward of the sympathetic through the intervertebral foramina, and by ganglionic fibres from the nerve roots which pierce the neuralemma, and are reflected inward and upward in opposite directions.

The deep osseous tissues, ligaments and cellu-

lar elements in the dorsal region, are provided by the posterior ramifications of primary division of the twelve dorsal nerves. The anterior branches of the six lower dorsal nerves supply the three sets of muscles which laterally wall in the abdomen.

The arrangement of the lumbar nerves is similar to the dorsal, but it may be noted, in all the regions of the vertebræ, that, beginning in the superior segment, the cervical nerves send prolongations into the thoracic region and freely inoculate or are blended with its nerve-trunk, the dorsal with the abdominal, and the lumbar with the pelvic or sacral nerves.

As a result of violence to the spine we may have hæmorrhage, laceration of substance, inflammation, peripheral paralysis or neuritis. The consequences arising from these various conditions are important or serious in proportion to their extent, the age of the patient, sex, and the condition of health. One of those pathological conditions may be dependent on the other. For instance, sanguineous extravasation into or along the muscle sheaths, if properly treated and of moderate extent, will rapidly disappear. But under varying circumstances it may give rise to irritation, inflammation or suppuration. Local inflammation may be confined and its spread prevented.

As a rule, however, unless very great injury has been inflicted, the processes of repair in the spinal coverings are rapid and complete. This may be explained partly, perhaps, by their greater vascularity and elasticity.

There are, nevertheless, occasions when a muscle is subjected to sudden and considerable strain; the result may be very serious. Such we sometimes meet with, in those cases of irreducible luxations at the shoulder joint, in which the muscle has lost its elasticity with contractility, and we fail to reclaim the head of the humerus in position after replacement. Dire results may follow rupture of the meningo-rachidian veins. Their walls are very thin, hence, when ruptured, fail to close in the rent. Bleeding from these vessels is a most prolific source of secondary inflammation, of the meninges and pyelitis, by pyogenic processes, propagated either through the lymph channels or the blood vessels, which, in this situation, communicate very intimately.

Primary and direct disorganization of the osseous structures of the spine, without mortal implication of the medulla-spinalis, or such a lesion as will at once and permanently destroy the conducting power of the spine below the area of contact, is very rare.

Pathological changes involving the bones of the spine, after injury, are mostly secondary, and are not often seen, except in early life. Even then, when met with, after an alleged injury, it might become an important question to decide just what part the traumatism exercised as an etiological factor in the initial changes, or whether or not the necrosis or caries was rather attributable to influences originating within the organism itself, the development of which, immediately following accident, being rather an adventitious circumstance.

The same observation might apply to synovial implication of the manifold articulations of the spine.

In all grave spinal traumatisms, provided the patient receive immediate shock, spinal-meningitis arises, and, in time, the brain shares in the changes which commenced in the cord. Hence, when the basillar membranes are reached, and those of the medulla-oblongata, the respiratory centers become the theater of inhibitory action, and life is quickly terminated.

The subarachnoid cavities of the brain and spinal cord freely communicate. In serious injuries of the cord we often have premonitions of approaching dissolution, accentuated through the nerves coming from the cord, within the skull, while all the mental faculties are yet undimmed, and the patient himself is warned of the terrible change which awaits him only by indications made manifest through those nerves which preside over respiration and phonation.

Very much has recently been written concerning what is designated "concussion of the spine" —a condition which has no definite pathology, and the existence of which is mostly based on a series of vague and ambiguous symptoms. In other words, it is revealed mainly by clinical phenomena.

It is alleged that its striking characteristic is the fact that it manifests its effects only after the lapse of considerable interval from the time of injury; is exceedingly insidious in its onset, but withal, may have a speedy and favorable termination; that it is always followed by psychical disturbances of an emotional character, impairment of vision, ataxic symptoms, unsteady gait, pain in the back, headache, and a general breaking down of health.

Many distinguished authorities agree that as a result of violent physical shock, we may have a condition of the brain or cord in which there are well-marked evidences of serious pathological disturbance, and yet, after death, no gross lesions of structure are found to account for them.

No one who has examined many bodies of men or women who have come to their end by a catastrophe but must admit that not infrequently practically nothing can be found which unequivocally accounts for death. Yet, from my own experience, I feel confidant that in many of those cases set down as spinal concussion, wherein there is no shamming, pathological changes may be discovered which will account for symptoms.

It is preposterous to assume, then, when vio-

lent and concussive force is applied to the body, that that slight, delicate cord, firmly enclosed by the dura-mater, and protected within a powerful, bony wall, will suffer detriment, while the exposed, friable viscera escape.

Dr. B. A. Watson's experiments on animals have definitely decided this question.

The spinal cord, we are told, may become anæmic. The patient, they say, has "anæmia of the cord." It is said to be a morbid condition which arises solely as a result of railroad accident.

A most ingenious theory has been devised to connect cause and effect in this new addition to our nomenclature of disease.

The imagination and credulity of the observing and thinking student are strained to the utmost to reconcile many of the unsupported theories and allegations of its discoverers and votaries.

In order to maintain the theory, and give force to reasoning, something more is demanded than hypothetical assumption and illogical conclusions.

It is imperative and proper that the profession be enlightened on some of those moot points, which have been ignored or warily evaded by those who have written most on this mysterious disease. In the beginning, we must be convinced that the emotional state of terrible alarm, trepidation and suspense attendant on a railway collision are different in quality and magnitude from those which must be of frequent occurrence in the carnage of battle, during the firing of heavy guns, explosions of shells, and springing of mines, from that borne by the wounded when a whole limb is torn away, or when the maimed and crippled, unable to withdraw their mangled, bleeding bodies, are ridden over, or trampled on, by the columns of advancing cavalry or artillery.

Can the horrors of railroad calamity exceed those which accompany the crashing destruction of a thunderbolt, when it falls with destructive energy on a dwelling, lifting it off its foundation, cleaving it in two, killing outright, in an instant, one or more individuals, yet, with the survivors, how many of them suffer from spinal anæmia?

In our large cities, with their numerous, enormous modern apartment houses of great height, from which occupants or mechanics often fall in every attitude of the body, here, accordingly, the hospital surgeon will meet with every variety of spinal injury. In no case which I have ever seen of spinal injury was there ever observed by me that mental aberration which is said to constitute that condition which is said to be an integral part of spinal anæmia.

Next in importance to those symptoms reflected through the organ of the mind in spinal anæmia is that condition in which the spinal cord is the seat of pathological changes, or rather its molecular, vascular elements.

It is not clear whether we are to understand by this, that the quantity of the blood present is diminished, or whether its nutritive, reconstructive elements are deficient, for the demands of the cord. Presuming that the pathological condition can exist, as a sequelæ of a violent shake of the body, there is no difficulty in the way of arraying symptoms almost indefinitely, as arising from or dependent upon it.

But, what proof is there from an anatomical, physiological or pathological standpoint, that such a condition is probable; that such a phase of spinal disease is possible; that the vascular supply to the spinal cord is obstructed, diminished or altered, so that its nutrition is disturbed, or that its cellular elements are impoverished, while all the other organs of the body are functionally active? Organs stimulated by the same nervous systems, the same blood current, under the same physical laws and influenced by the physical and chemical changes.

All such proof is totally wanting; nay, on the contrary, in mechanical anæmia of the organ or limb induced by the surgeon, there is no analogy whatever, to the symptoms resulting and those said to be associated with "spinal-anæmia." On ligature of the femoral artery, as it emerges from under Poupart's ligament, we will notice a cooling of the limb arising from the emptying and collapse of the peripheral capillaries and loss of heat. Owing to veinous stasis and temporary diapædesis, there is a sense of fullness in the connective tissues; but usually no pain, except where the ligature was applied and perhaps a nerve branch was injured.

With the brain itself, although one or both of the carotid currents is dammed back, we may immediately notice the physical effect resulting; yet nothing will present itself, having the slightest analogy to this new disease. We have other instances of mechanical, accidental, or pathological exsanguination in which every organ must contribute its share in the general loss, the spinal cord as well as others, but the local impoverishment of the spine, here, is not demonstrable by any special symptoms.

From the foregoing, it is evident that there is absolutely nothing whatever, which should permit the continuance of a supposed pathological entity which has no substantial existence. We have no right, in these days, when instruments of percision are at hand, to assume the existence of a malady demonstrable, if at all, rather by therapeutic than pathological proof. It being supposed that certain functional disorders are present, which indicate impoverishment of the cord, medicines are given, which supply tone to the muscles, enrich the blood and act as a spur to the nervous system. But it is inconceivable

how one can infer from therapeutic induction alone, that the spinal-marrow is the center of a morbid change, when the system responds to constitutional tonics or alteratives that act on every fibre in the organism. It would be just as illogical to argue that there was a localized anæmia in the sciatic nerve, when, through some acute malady, the bodily strength is at a low ebb.

The actual pathological condition which the patient suffers from, in so-called spinal-anæmia, is unquestionably a peripheral neuroses, of a neuralgic character. As a matter of observation, it is well known that along the central and lateral planes of the spine there are local diseased areas, whose principal manifestations are pain and hyperæsthesia. This pain may be localized or diffused; constant or intermittent. It is usually regional. It is a condition of adult life, and is much more common in women than men.

There is always a well-marked derangement of the general health. The hepatic functions are languidly performed. The patient has loss of appetite and is constipated. He is pale, leucocythenic and weak. If a woman, there will be menstrual disturbances. What constitutes its essential clinical differences in the sexes, is its local, neuralgic manifestations, its seat of selection.

With the male sex it is very uncommon, though when it does arise, its location will be in the lower lumbar and gluteal regions; or those parts supplied by the peripheral, or muscular ramifications of the posterior division of the lumbar and sacral nerves. Then we will have what is designated lumbago or sciatica.

With woman, these neuralgias generally radiate through the nerve-filaments from the anterior branches of the six upper dorsal nerves, on the left side, and also, along the pelvic fibres of the anterior crural, which penetrate the ovary. Here, too, singularly, pain is most frequent in the left side.

These neuralgias, intercostal and ovarian, then, are a consequence of a general debility, malaria, and functional disturbances, and are not dependent on traumatism of the spinal cord.

These neuroses belong to that class in which the faith-healer and charletan reap a rich harvest; or in which anyone, who can make a sudden and positive mental impression on the mind, will meet with marked success, when internal medication fails.

Many phases of this, so-called, anæmic spine, will yield to internal, reconstructive remedies, as quinine, iron, arsenic or mercury; good dieting, sea-bathing, change of air, travel, faradization, shampooing, massage, dry cupping, plasters, etc.

The above may seem rather a digression from the strict text; but under the circumstances, it forms an important constituent of our theme, as it is, in reality and fact, no fanciful or imaginary picture; but is a truthfnl résumé of what has evidently been erroneously designated "anæmia of the spine."

I have endeavored to completely demolish the artificial and unstable foundation on which it rests, and tried to demonstrate that this "*railroad* spinal anæmia" is a myth; but is, unhappily, often a source of distress among many who have never seen a railroad.

Having so far considered the etiology and clinical history of those lesions and derangements attended with definite and precise pathological changes, and other maladies assumed to succeed concussive force applied to the back, it is now necessary to extend our field of inquiry from the parts which directly enter into the composition of the spine, to the cavities which it posteriorly walls in, the abdominal, thoracic and buccal.

The abdominal cavity contains four fixed, solid organs, dependent and suspended, having no bony encasement, and lying immediately anterior to the flexible lumbar curve, and are frequently exposed to injury from indirect violence.

It is in this situation, that is most frequently seen, destruction, limited or extensive, from transmitted force; as when the liver, kidney, a distended stomach, bladder or gravid uterus, suffers laceration or rupture.

The renal organs suffer most frequently. Their juxtaposition to the spine, behind the peritoneum, when their meso-nephron, or the enveloping layers of fibro-cellular tissue, is dense and firmly fixes the organ in position.

With the exception of grave injury of the cord, as a complication, I had never seen but two cases of injuries of the back in which there were evidences of kidney complications in extrinsic lesions. One of those cases, a physician, who, while aboard what is known as a cable-car, was injured. These cars stop and start suddenly; so that, unless managed by a competent gripman, there are almost constant jars and starts, in their working. He had but entered the car and was advancing towards the front, when it gave a lurch forward, throwing him violently backwards against the iron-arm of a seat. The doctor was unable to rise unassisted, and suffered from shock for several hours. The day following injury, he had hæmoptyses and bloody urine. By proper remedial measures combined with rest, after ten days the hæmaturia ceased, and he was able to sit up. His recovery to health was slow, though in time he quite regained his former vigor.

I have never seen hepatic disorganization, as a sequence of spinal injury, unless mental force had been sustained.

This leads me to infer either one or two things in this connection. The liver may suffer peripheral or central disintegration, when this does

not involve the large bload-vessels, with quite unique impunity, as it undoubtedly possesses within itself the property of complete and rapid repair. It may, perhaps, be partly attributable to its situation which, when attentively studied, will be found to have a configuration and position which effectually provide against extensive damage by violence, and guards it against sudden concussive force. It has long been a matter of observation by physiologists engaged in experimental work on the liver, of lower animals, and by surgeons operating on hepatic structure, that if the primary gush of blood could be controlled, little difficulty would be experienced; as the triple compound, circulating through the lobules, possess marvellous hæmostatic properties, and plastic inflammation with rapid coaptation, was the rule.

Only the free, thin-edged borders of the liver are exposed. The solid, compact mass of this organ, has a broad and intimate attachment to the inferior surface of the diaphragm. It rises high up under the shelving margins of the ribs and rests on a surface well calculated to receive and scatter concussive force, as it lies at its anterior, superior, and greater part of its posterior border on an air-cushion—the highly elastic and expanding lung.

I know of no recorded case, wherein the spleen suffered laceration in connexion with spinal injury.

The stomach in a distended state, lying on its posterior surface, in immediate contact with the vertebral bodies, one might expect, would easily rupture. It, however, is singularly invulnerable to physical shock.

Certainly, it goes without saying, that violent concussion, sustained, through transmission, by the uterus, when impregnated more than three months, almost inevitably leads to abortion or premature delivery.

The contents of the thorax, the circulatory and pulmonary organs, are seldom involved in severe injuries to the back. Very often, force brought to bear will so compress the chest antero-posteriorly as to induce multiple, costal fracture. The pulmonary parenchyma is very tough and will resist great pressure. I have never seen rupture of the heart from concussive force, through the dorsal region; although Watson has observed such a complication in his experiments.

An injury of the cervical vertebræ sufficient to compromise the integrity of the buccal cavity, alimentary or air-passages, must be almost inevitably fatal.

MORBID ANATOMY AND PATHOLOGY OF TRAUMATIC SPINAL LESIONS.

Morbid changes of structure, resulting from injuries borne by the spine, vary according to manifold circumstances, to the quality and force applied; the time intervening from the accident; the age and condition of the patient; the extent of parenchymatous changes and degree of reparative effort.

If the violence have been shortly followed by death, little will be noted, except extensive laceration of the parts, with disorganization, partial or complete, at the seat of injury. There may be ecchymosis of the integuments and evidence of some bleeding in the underlying tissues, its quantity and quality being dependent on the degree of shock, heart depression, chemical and vital changes.

I have frequently noted that when the bleeding is eccentric to the spinal-canal, the blood is commonly more or less coagulated; but when within the bony rings of the vertebræ, whether intra- or extra-meningeal, is always of a dark liquid consistence.

In those who have succumbed from lesions entailing much loss of blood, with compression of the cord resulting therefrom, I have invariably found the hæmorrhage located *external* to the meninges spinalis, and coming from the laceration of the meningo-rachidian or the longitudinal spinal sinuses.

Intra-meningeal hæmorrhage, either from the fine capillaries on the serous surface of the dura-mater or the medulla-spinal viens of the columns, horns, sulci and substance of the cord itself, I have never seen. Possibly it may occur as a pathological process in certain constitutional maladies, but as a result of an injury it can never occur, except in connection with mortal destruction. It is well to remember that the cord, weighing but an ounce and a half, has but from sixty to eighty drops of blood ever circulating in it, that it is swung in a chamber holding nearly three ounces of fluid, by which it is surrounded on every side, and nowhere comes in contact with the bony walls which enclose it.

Hæmorrhage within the theca seldom is seen, *post-mortem*, to rise above the mid-dorsal region. The adjacent fibrous tissues are always deeply stained and occasionally the hæmorrhage will find its way outward through the inter-vertebral foramina in the direction of the nerve-trunks.

I have not yet seen any cases in which advanced changes in the direction of this integration were noted.

When hæmorrhage has been considerable, not disappearing by absorption, we will find associated with it changes attributable to congestion and inflammation. The vessels on the thecal and serous surfaces of the dura-mater are greatly distended, the subarachnoid fluid is turbid, and small flakes of lymph may be seen floating in it. In places the piamater and arachnoid are glued together, by adhesive inflammation. The cord itself is softened, and under the microscope are seen along the periphery of the white matter

round cell infiltrate with leucocytes and granular matter intermixed.

All the membranes are markedly thickened and have a deep congested hue.

The soft tissues overlying the spinal cord in spinal-meningitis, as with all other tissues which overlie an inflamed serous membrane, as those of the abdomen, thorax and skull, are always considerably thickened and distended by an inflammatory exudate.

There will be found at times, evidences of bone implication, synovial destruction within the capsular ligaments, and sero-purulent formations.

The pathological changes observed during life after spinal injuries, are important to correctly comprehend. They may, for purposes of description, be divided into four classes: 1. Eccentric lesions; 2, centric lesions; 3, organic lesions; 4, functional disturbances.

Eccentric lesions are those of the structure which are situated external to the spinal canal and involve the bony architecture, the motor leverage, circulatory system, mainly, and peripheral nerves. They are dependent on pressure, tension or laceration. In the vast majority of cases, being of a trivial nature, they give little inconvenience; but when the back has borne great and considerable force, we may witness such lesion of muscle or other structure as will cause temporary or permanent loss of function. If inflammation supervene, the residuum of its deposit may undergo fibrous changes and so bind the sinewy structure together, as to occasion muscular anchylosis, pressure on the nerves or blood-vessels and amytrophic changes, in all the tissues. If the integuments and the subjacent tissues are lacerated we can readily comprehend how, through the intimate connection between the dorso-spinal and meningo-rachidian vessels, septic processes may be transported to the enveloping membranes of the cord.

Primary congestion or inflammation in the inter-muscular connective tissues seldom give rise to organic changes, and readily subside. But a severe injury, the widespread effects of which involve *en masse* all the tissues, may be followed by a low grade of inflammation, implicating the vascular supply, giving rise to a phlebitis or strombosis of the superficial or deep veins, in this manner seriously interfering with nutrition and inducing a softening or wasting of the muscles. The bony structure of the spine usually escapes an injury unless great violence is borne. In children, however, this immunity does not obtain, especially when tubercle is inherited.

In fractures of the spine, so-called, everything will depend on the direction which the fragments have taken. If the broken bone be crushed in, on the cord, we will have hæmorrhage, inflammation and softening, while if there be slight displacements, the cord may escape. We have no proof that the bones of the spine will regenerate; certainly if they are allied anatomically and physiologically with those of the cranium, which is claimed by some anatomists, then they are destitute of osteogenetic power.

Simultaneous or consecutive osseo-arthritic changes of an inflammatory nature in the vertebral joints seldom extend to the cartilagenous pulp between the bodies in the absence of constitutional cachexia. The pain along the spine in various regions according to where concussive force is applied, is dependent, I am convinced, rather on a low grade of cellulitis, involving the muscles and tendons, than a peripheral neuritis.

Centric lesions of the cord, accentuated by clearly defined symptoms and resulting from trauma, are very seldom met with. Although I have seen and treated now more than one hundred and fifty cases of fracture of the vault of the skull, up to the time I reported them in Oct., 1890 (Trans. New York Medical Ass'n., 1890), and saw more than fifty fractures at the base, besides very many cases of cranial injury in which spasm or paralysis followed and the patients recovered; in that seventeen years experience I had under my care but ten spinal injuries of an intrinsic character, so that on a reasonable calculation, in falls, blows, or collisions, it may be said that the proportional injuries of the cord with that of the brain under those circumstances, was rather less than one to twenty.

As the spinal cord cannot be stretched nor sundered by concussion, we must direct attention mainly to the effects of pressure; pressure by bone, luxated or fractured, or pressure by blood; by an excess of serum, lymph, a plastic exudate or pus.

Should a large spicula of bone be driven in or through the meninges, the cord is irreparably disorganized beneath it. Fractures of the lateral arches, involving the transverse processes, imply great violence, and I believe are always fatal, either immediately or remotely. The spinous processes in slim subjects being very superficial, give way to force most frequently; but owing to their inclined, overlapping adjustment and numerous ligamentous supports, are dislodged with difficulty. When bone pressure is moderate but constant, along with producing paralysis, involving the motor or sensory nerves, or both, it gives rise to meningitis and myelitis. Before necrotic processes of the osseous structures is complete, the patient has usually succumbed.

Intra-spinal hæmorrhage, after severe injuries of the back, by pressure, may induce temporary paralysis, meningitis or molecular degeneration of the medullary substance. The pathological changes which it induces are those characteristic of pressure exercised by a solid substance. The effused blood being confined within an air-tight chamber, in which the circulation is necessarily languid, absorption is slow and imperfect.

Spinal meningitis, resulting from trauma as a primary affection, is very rare, except in the presence of fracture. Commencing as a local and well-defined affection, its tendency is to spread upward into the basic meninges of the brain.

The peripheral sensory nerves in spinal meningitis are always morbidly susceptible to impressions, and the reflexes in the early stages of the malady give rise to intermittent or constant spasm of the muscles.

Authors have in turn framed different theories to explain the predominance of one phenomenon over the other in those meningeal inflammations, when at one time we will have anæsthesia or hyperæsthesia in a limb which is motionless.

They have sought to justify and prove their conclusions by experimental physiology, ascribing one set of symptoms as attributable to pathogenic changes in the antero-lateral columns of the cord; another, to the posterior columns; to the grey matter and white substance, alternately. These views are, however, merely speculative, and are lacking the confirmation of post-mortem examination. Admitting, nevertheless, their scientific accuracy, it would, as far as we know, in no way aid their surgical management. Meningeal inflammation, although, as its stages merge one into the other, thus inducing pain, spasm and paralysis of the lower regions of the body, is compatible with consciousness and life, until the upper cervical segment of the spine and base of the brain are involved.

Irregularity of cardiac and respiratory action, with twitching of the facial muscles, loss of speech and the power to swallow, slowly developing deafness and dimness of vision, announce that the roots of the cranial nerves are involved and that the end is near. As we invariably witness spinal manifestations in cerebral meningitis, so in grave spinal meningitis the vital and psychological functions of the brain never escape. Organic lesions of the cord, arising independently of constitutional causes, are infrequent.

The medulla-spinalis is seldom involved in inflammatory processes without the participation of the meninges, the latter being the primary structure to take on inflammation.

When the spinal marrow undergoes interstitial or molecular disintegration, as a result of trauma, along with constant pain over the integuments of the back, which often, too, is reflected along the sensory nerves into the extremities, we will see paralysis, spasm or hyperæsthesia, which will correspond with that area of the cord supplying the affected group of muscles.

As I have never seen the seat of traumatic pyelitis or pathological changes limited to the cords alone, post mortem, I cannot speak from personal observation; nor can I find such a condition even mentioned by such world-renowned pathologists as Virchow, Paget, or Billroth.

We must turn to medical pathology for information relative to those fine structural changes which occur in the pulpy matter, for, no doubt, like pulmonary tuberculosis and Bright's disease of the kidneys, those microscopical changes in the nerve-cylinders invariably depend on systemic influences solely, and not on violence of any description; hence what has been written so fully relative to pathological changes in the spinal marrow has but little application to surgical or traumatical lesions of it.

Of the functional neuroses of the spine, their name is legion. In a surgical essay on spinal diseases, their consideration from a pathological stand would seem a work of superrerogation, if it were not claimed that many of them had their starting point in an injury. They have been designated spinal anæmia and spinal congestion, spinal concussion, etc., and one author (Hammond on the Nervous System, page 217) has even gone so far as to further subdivide them on a physiological basis into anæmia or congestion of the antero-lateral and posterior columns. An imaginary pathology has been elaborated, with considerable detail and circumspection, to correspond with the views and notions of the authors, and we are told now that precise localization of spinal lesions is a matter of great simplicity. We are told that certain cells within the grey matter and white substance degenerate and regenerate under the influence of the circulation, which, at one time, is excessive and another diminished; that one train of symptoms is dependent on one phase of the blood supply, another on a contrary. Now, as no one has yet been able to demonstrate by an autopsy the pathological changes, if any are present, the necessary proof is wanting to support these assertions.

These allegations are dependent wholly on empiricism. When subjected to the rigorous test of scientific analysis, they fade away into nothing.

Very many of these spinal neuroses of a functional nature are chiefly hysterical, epileptic, or choreaic, probably dependent on hereditary influences, sex or habit, which act through the blood. Their pathology cannot be definitely written yet, for it is not understood. Without question, however, we may rather look to the cerebral organs for the central trouble than the medulla-spinalis.

THE DIAGNOSIS OF INJURIES OF THE SPINE.

Before the days of Lænnec, every species of acute inflammatory affection involving the lung, its parenchyma, its tubular structure, and serous investment, was designated "a pleurisy," and all were treated on the same general principles, by essentially the same remedial agents. But there came forth a genius, who applied the revelations of physics to vital phenomena within the

human body, and he taught how, by the aid of the eye, the ear and the tactile sense, we might not only recognize the different structures involved, but that we could, with certainty and precision, estimate the progress or retrogression of the pathological changes within them. Now, though of great value, this application of physical laws to the elucidation of pulmonary diseases, for diagnosis and prognosis, yet the late famous clinical teacher, Thomas Watson, said, in speaking of pulmonary disease: "It may seem paradoxical, but the very perfection of the physical diagnosis of pulmonary diseases, has often constituted an impediment to their treatment."

Spinal diseases taken collectively, as a whole, were in the same chaotic state, at the beginning of the present century, as were maladies of the lungs before the days of Lænnec. But through the discoveries and experiments of Magendie and Bell, the functions of the nerve roots are now known, and by the aid of Brown-Séquard and other experimental pathologists, we have been made aware of the special properties resident in the columns and matter of the cord, itself.

Surgical pathologists have made it possible for us to differentiate the inflammations or pathological changes in the various structures which envelop the medullary cylinder, from within outward. And hence, to-day, not as formerly, we are enabled to speak definitely of the idiopathic or traumatic affections which may occupy any area of the spine, or its organic components.

It may not be always possible to effect a definite diagnosis immediately after an injury of the spine has been sustained, unless very great violence was applied, and the cord itself suffered direct and positive pressure from displaced bone, or fracture, under which circumstances, complete and instantaneous paraplegia is invariably a symptom of mortal omen.

At the first visit to our patient, we may find him suffering severe pain in all the joints below the sacro-lumbar articulation and upward along the lateral planes of the spine. He is unable to raise the body or elevate the lower limbs without very great difficulty, even if it is possible at all. He has perfect control of his sphincters, and sensation is nowhere impaired.

The family, friends, or patient himself may now demand of the medical attendant information as to the nature and extent of the injury. This cannot be stated at this visit, but I feel assured, from my own experience in a large number of spinal injuries, that, however, it will seldom require but a very few days before we can, with certainty, say whether the spinal marrow is involved or not. Hæmorrhage, inflammation, serous or purulent effusion, will present symptoms of such a clear and unmistakable type, that one cannot be deceived or incapable of interpreting their clinical significance.

The most serious, but infrequent, lesions attending violent injuries to the back, are those which have reference to the cord and its membranes.

These are of a primary and secondary character. With the former, we are promptly apprised of direct medullary implication, by the presence of paralysis in the lower members, complete or incomplete. Primary paraplegia after the injury is usually induced by pressure, which effects the disorganization of the cord, destroying its conducting power. We are not always able to precisely define the exact situation or extent of pressure, for an arch or lateral plate of vertebra may have been fractured and forced into the spinal canal at the time of accident, but, owing to the elasticity and strength of its connecting ligaments, with the rebound, it is retracted away from the indented cord. And, on examination, although there may seem some slight increased mobility of a projecting vertebral spur, we cannot always assume that there is displacement.

As a diagnostic aid, we might have recourse to an exploratory incision, so as to effect a more accurate estimate of the effect of the injury, and to guide us in the way of treatment.

But, although this might be a theoretical advantage in serving a dual purpose, yet practically it cannot, only in very exceptional circumstances, be regarded as a permissible procedure. Possibly, under extreme circumstances, might a free incision into the tissue be allowed as a therapeutic measure—as a diagnostic, almost never.

Fortunately, in the presence of total inhibition of the spinal or neural functions in the lower extremities, we may pronounce the lesion in the spinal cord one of an irreparable character, resulting from direct and permanent disorganization of such a description that, even though the cord were stripped of its investments and completely accessible, we are powerless in the way of instituting remedial measures.

Traumatic compression, laceration, or disintegration of the spinal cord, accordingly, may be said to be a condition of easy diagnosis, when complete paraplegia is present. Certainly, when bone is fractured, but is not displaced, and no symptoms are present indicative of paralysis, we cannot, in the deeply buried lines of the back, always make an immediate diagnosis. It is of little consequence under these circumstances, however, that we fail to correctly ascertain the extent of lesion, for it will in no way influence remedial measures, or affect prognosis.

Unfortunately, however, when the cord and its membranes become secondarily involved, some days or weeks after injury, diagnosis is attended with many perplexities.

Next to osseous pressure, in producing organic changes in the spinal cord, will come hæmorrhage.

Paresis following hyperæsthesia within twenty-

four or forty-eight hours of the injury, will be suggestive of intra-spinal hæmorrhage. Its volume may be estimated by the extent of paralysis and the areas affected. When the viscera supplied by the lumbar plexus show evidences of paralysis, and the sphincters of the bladder and rectum fail to act, we may assume that the effusion has mounted up to the dorso-lumbar junction.

It may require a very nice discrimination in diagnostic tact to differentiate, at the outset, intra-spinal hæmorrhage from meningeal inflammation. But the patient's exsanguinated condition, the deep-seated pain from pressure, the absence of chills, acceleration of the pulse and of rising temperature, all point to the exclusion of inflammatory changes having yet occupied the meninges.

Our diagnosis of intra-spinal hæmorrhage will be corroborated if, within a week's time, amelioration of the symptoms is present, and restoration of function is being gradually reëstablished.

Extensive hæmorrhage from the dorso-rachidian vessels, when profuse and localized as an intra-muscular hæmatoma, may be recognized as a sanguineous effusion which, in the healthy individual, rapidly vanishes by absorption.

Changes of an inflammatory character in the spinal cord are manifested by a diversity of symptoms. First, by constitutional phenomena, which profoundly impress the nutritive processes and local conditions. The patient has fever, quick pulse, rising temperature, is thirsty, has neither sleep nor appetite.

There is always pain in the back in traumatic spinal meningitis, associated with extreme peripheral tenderness, localized or extensive anæsthesia along the extensor or flexor surfaces of one or both limbs. Thus a clonic spasm, unilateral or symmetrical, is always present, provided there has been no implication of the medulla. When there is this association, the cord having lost its connective power below the seat of lesion, spasm will be noticed only above this limit.

We are perhaps justified, in the presence of a certain set of symptoms, in assuming that we may, at the outset, be able to localize the limit of meningeal inflammation. This would seem all the more positive when, in the presence of every symptom of incipient meningitis, we succeed, by the active interposition of therapeutic resource, in arresting its progress. Accordingly, we may assume that the lumbar segment, the cauda equina, is the primary and only region affected when paralysis, paresis, hyperæsthesia, spasm or muscular twitching, is confined to the parts supplied by the nerves whose roots are located in this district. Stiffness, pain or spasm in the muscles supplied by the lower dorsal segment, those muscles animated by the lower six dorsal nerves, viz.: the deep spinal muscles of that region and the three sets of muscles which anteriorly and laterally wall in the abdomen, the external and internal, oblique and transversalis. Hence, the muscles of the back are hard, stiff and unyielding, and it is noteworthy at this juncture, that the patient begins to complain of a most oppressive sense of weight and constriction over the abdomen, which he compares to being drawn tightly by an encircling cord, the abdominal muscles pulling in an opposite direction; or having a heavy weight resting on the præcordia. The movable wings of the thorax are locked and fixed by an intermittent spasm of the lower intercostal muscles, and respiration is maintained principally, now, by its auxiliary muscles, the cervical and scapular, with the aid of the diaphragm.

Meningeal inflammation having compromised the entire dorsal district, we have anticipated it, as it were, *i. e.*, knowing, when this area of the arch is invaded, our patient—whose mental faculties remain as yet unclouded—is warned of his impending danger, and given time to prepare himself and arrange his affairs—as, with but another slight advance into the cervical region, the implication of post-thoracic and the phrenic nerves, when asphyxia will terminate the struggle.

The diagnosis of cervical meningitis is unimportant, as the general meningeal disease is wholly beyond our control, and swiftly fatal, when this area is occupied.

I have seen in several fatal cases, a rather singular clinical phenomenon, in the upward march of inflammatory changes. It was this: that whereas the extension of the disease, from the lumbar to the lower dorsal district, may occupy several days and be extremely insidious in its advance, but, when it was finally manifest in the dorsal segment, it often, within the lapse of a few hours, spread into the cervical region and quickly terminated life.

CONCLUSIONS.

In dealing with the foregoing subject, my aim has been to compress within a small compass as much as possible, without omitting any important detail; but I fear, with the space at my command, in this I have but partly succeeded. Quotations and the historical part of the subject have been largely omitted.

In presenting the study of spinal lesions my object has been, rather, to make it clear and comprehensive than to confine myself rigidly to any arbitrary arrangement of matter; for, regardless of what pains may be taken in constructing an article, under various headings, the divisions and subdivisions are often more relative than absolute.

Very little or no notice at all is given to the subject of traumatic lesions of the spine, in text

books, or even encyclopædic works on surgery; hence, we are justified in assuming that serious injuries of this structure are rare, or else, that surgeons have given them very little attention.

An attempt has been made here to isolate the complexity of lesions following severe injuries of the back, and not confound the consequences of one with the other, to demonstrate that grave injury may be sustained in the rachidian region without any implication of the cord.

Accordingly, in the light of our present knowledge, and after a careful study of normal structure and function; the physics of force which give rise to spinal injury; experimental investigation, clinical phenomena, pathological changes and morbid anatomy, it may be definitely stated:

1. That in the vast majority of cases in which complete paraplegia immediately sets in, after spinal injury, it may be assumed, with almost positive certainty, that the medulla-spinalis has sustained a palpable lesion of its integrity, which usually ends mortally.

2. That there is no proof that mere concussive force will either simultaneously or consecutively ever lead to paralysis, without inducing well-marked and positive pathological changes in the anatomical elements of the cord.

3. Physical force and the psychological effects of fright being the same in railroad as other injuries, there is nothing to justify the claim that there are grave lesions of the spine resulting from railroad collisions which are characteristic and peculiar.

4. There being no proof of the existence of such diseases as anæmia or hyperæmia of the cord, as pathological entities, they are entitled to no place in the nomenclature of traumatic spinal diseases.

5. Eccentric lesions of the back, without any implication of the cord, may, nevertheless, by pressure on the meninges secondarily give rise to meningitis, local or general; also by infection, propagated inward, ultimately effect the medulla-spinalis. Those extrinsic injuries may, too, of themselves, by inducing pathological changes in the bones, cartilages, joints or muscles, occasion a permanent weakening or loss of power in the back.

6. It should be constantly borne in mind that there are always essentially two different and distinct sets of pathological lesions which result from spinal injury, viz., those involving the cord, of rare occurrence and generally fatal, and those exterior to the spinal canal, very common, but seldom giving rise to serious impediment of function.

THERE are in the United States and Canada forty-seven medical faculties which admit students of both sexes, and nine for women only.

ELECTRO-DIAGNOSIS IN BRAIN AND NERVE INJURIES — METHODS USED AND THE APPARATUS REQUIRED.

Read before the Section of Medical Jurisprudence and Neurology, at the Forty-second Annual Meeting of the American Medical Association, held at Washington, D. C., May, 1891.

BY W. H. WALLING, M.D.,
OF PHILADELPHIA, PA.

There are two very important propositions to be considered in connection with electro-diagnosis, the first of which is, an adequate knowledge of electro-physics and electro-physiology, and the second, the need of the proper apparatus with which to conduct such investigation.

The first proposition, or a proper understanding of the subjects named, is so obviously essential that it is scarcely necessary to discuss it.

The apparatus required for accurate electro-diagnosis merits our careful consideration. While with an ordinary faradic battery and common electrodes the approximate condition of a nerve may be arrived at, our tests will be of only a proportionate value.

The batteries, meter and controller that I use here to-day were made by Mr. Otto Fleming, of Philadelphia.

Unfortunately, we have no definite standard in this country for our faradic coils, or for the size of our electrodes, hence the resulting confusion in comparative tests by different operators. It is to be hoped that the American Electro-Therapeutic Association will, at its next meeting, appoint a committee to consider this very important question of the standardization of our apparatus and electrodes. This is secondary in importance only to the proper standardization of the fluid extracts and tinctures of the U. S. P., which I so strenuously advocate.

For electro-diagnosis three different currents are used, the faradic, the galvanic, and the franklinic. The faradic coil, which I use in diagnosis, which I here show you, is constructed upon the DuBois-Reymond principle, and graduated, by means of a scale, into centimeters and millimeters. The cell used to operate this coil is a modification of a grenet cell, and has an electro-motive force of one and a half volts. For my stationary coil I use two modified Law cells, as they are less troublesome, and are quite constant in action. The dry cells have not, as yet, met our expectations, when used upon the faradic coil. It must be remembered that the cell, in all faradic machines, is on what is termed short circuit when in use, hence the dry cell, having a tendency to rapidly polarize, soon runs down, and the battery will not work until the cell has time to recover.

This apparatus is supplied with a slow, as well as a rapid interrupter, and the movements of the former may be regulated to suit the operator.

With a machine constructed upon this plan, the exact coil distance required to produce a contraction, if one be obtainable, may be observed and recorded, and active comparisons made from time to time.

It has been repeatedly stated that it makes no difference which of the two poles of the faradic battery are used, as the reaction of nerve and muscle is the same for both poles. I dissent from this statement. In testing a nerve with my office coil, for instance, I find that I can get a contraction with the cathode from six and a half centimeters coil distance, while seven and a half centimeters are required with the anode to get the same contraction. This from the primary coil. With the secondary coil the same contraction was produced by two centimeters c.d., cathodal closure, and two and eight-tenths of c.d. were required with the anode.

The electrodes selected to make the first examination should be used throughout the case. Erb recommends that the active electrode should be ten square centimeters surface measure; Stintzing one of three centimeters surface. Erb's instrument is the one most generally used. Both electrodes should be covered in the same manner, preferably with absorbent cotton, wetted to the same degree, in the same solution, and be placed upon the same spots on the body at each examination, and the pressure should also be the same as near as possible.

The size of the electrodes used make a vast difference in the amount of current required in order to produce a contraction.

For the purpose of general diagnosis, the patient is prepared by removing as much of the clothing as may be necessary, and, if a female, protected by a sheet or loose wrapper, and seated upon a suitable stool, upon which a wet sponge electrode is placed, attached to the positive pole of the secondary coil of a faradic machine. The operator then takes a small, well-wetted sponge or cotton-covered electrode, attached to the negative pole, and, commencing at the nape of the neck, with a current plainly perceptible to the patient, passes down the back upon both sides of the spinal column, noting the effect produced. If there are tender spots, they will be quickly apparent by the patient wincing, or saying that it is painful. Note the coil distance required to locate these spots. Anæsthesia may be present in some areas, and more current be necessary to produce an impression.

The tender spots indicate points of greater or less inflammation. Blood being the best conductor of all the tissues of the body, all such foci of congestion or inflammation offer less resistance to the current, consequently the greater amount will seek to pass in that direction, and cause the pain by reason of such density. Test both sides of the spinal column, and note all the reactions.

Pain is not always an indication of an inflammatory condition, or of a lesion, as when the sponge is passed around the sides of the patient, and over the ribs, more or less pain will be experienced, due to the effect of the vibrations upon the periosteum. This effect is always seen when the faradic current is used over bones which are superficial, such as the scapula, etc. As the electrode passes over the motor points of some of the abdominal muscles, they will be strongly contracted, but this is, as a rule, of no particular significance. For testing for anæsthesia, this small electrode will be found useful; also for testing the electro-cutaneous sensibility of various parts of the skin. It is made of a large number of copper wires, closely approximated, but insulated from each other, and placed in this hard-rubber case. The coil distance necessary to produce a sensation upon different parts may be compared. This electrode is to be attached to one pole of the secondary coil, and the other placed upon the sternum, and the coil distance required to produce a sensation noted. A painful impression is then given, and noted, when the active electrode is removed to the opposite side of the body, and the same test made, when the two may be compared.

Diminution of sensibility, or sensory irritability, is present in nearly all lesions of the spinal cord and peripheral nerves, which are serious in character, and is also present in many cerebral affections.

Stintzing has tabulated the normal reactions of nerves to the faradic current, a few examples of which I present. The numbers are the millimeters on scale:

Musculo cutaneous, contraction at 15 m.m.
Frontal branch of facial, 25 m.m.
Ulnar, at olecranon, 31.5 m.m.
Crural, 38.5 m.m.
Radial, 45 m.m.

As no two machines are alike, the value of these tables are only approximate.

THE GALVANIC BATTERY.

As the galvanic battery is our sheet anchor in definite electro-diagnosis, it is essential that everything be as perfect and complete as possible. The battery must be able to maintain a fairly constant potential, and for this purpose, especially for an office, or stationary battery, the Law or Leclanche cells are the best. The cells should be coupled in series; that is, the zinc of the first cell is attached to the carbon of the second, the zinc of the second to the carbon of the third, and so on until all are connected, the battery consisting of from forty to eighty or more cells. The two terminal wires from the end cells are run to the controller and meter, thus completing the circuit. This is the common arrangement, but I prefer to have each cell connected

with my switch-board, so that I may select any number, from one up to the whole number. My reasons for such arrangement are, that where you are using the whole battery, and attempt to control the current by means of the rheostat, the ampérage is alone controlled, and not the voltage. In this connection, I desire to enter my protest against the use of the Edison electric-light current for medical purposes. It will charge your secondary batteries, light your houses, your streets, and some of the cavities of the body, but I consider it unsafe and unreliable when used in place of a chemical galvanic battery. There is too much voltage, or electro-motive force, which cannot be properly controlled. But there is the greater danger of a short circuit somewhere, and of the whole current being thrown in upon an unsuspecting patient, with damage to health, and possible loss of life. Such accidents have happened, and are liable at any moment to be repeated.

It is also on account of the high voltage from the primary battery, when all the cells are constantly in circuit, that I object to the series arrangement. Suppose, for instance, that you wish to use one-half of a milliampére of current upon the eye; of what possible use have you for eighty to a hundred volts of pressure? Not only is such pressure useless, but it is hurtful, if not positively damaging. This I have demonstrated again and again, to my entire satisfaction. For instance, one of a series of patients referred to me by Prof. Keyser for treatment for facial paralysis, and now under my care, complains of intense pain in the supra-orbital nerve, with only one-half of a ma. of current, when I have fifty cells in circuit, the current-controller being also used, but bears one ma. from twenty cells, not only without pain, but with positive comfort. A painful and sensitive nerve quickly differentiates against voltage. It seems evident that as we throw in resistance, by means of a rheostat, we increase the pressure, and my rule is to use only just a sufficient number of cells to give the current strength I want, and no more. All above that number is a waste of force, and a positive disadvantage.

When making a diagnosis, the meter, but not the controller, should be in the circuit. DeWatteville's method is to place the electrodes in position, and commence with ten cells, adding cell by cell as needed, to get the reaction desired. I have tried various methods, but have gone back to DeWatteville's plan, as being the most satisfactory. For brain testing I have a separate series of ten cells, arranged according to my plan, and kept most exclusively for the purpose named.

Attention to polarity was seen to be of advantage, when using the faradic battery. With the galvanic, polarity becomes of prime importance, for the reaction of nerves is distinctive for each pole, and gives definite and unvarying results, when intelligently applied. Suppose that we wish to test the median nerves, in its most superficial portion, about two inches above the annular ligament. With the anode, or positive pole, placed on some convenient point, place this small electrode, attached to the cathode, or negative pole, upon the nerve, and turn on the current. So long as there is no break in the current, there is no movement of the muscle, differing in this respect from the faradic current. Having say two or three ma. the current is broken, and again suddenly closed. A quick, sharp, lightning-like contraction of a healthy muscle takes place, quickly subsiding. Upon reversing the polarity of the battery, we will find that it requires more current to get the same contraction with the anode, than it did with the cathode. Upon this has been based the following formula of normal reactions of nerve and muscles.

First we have cathodal closing contraction, c. c. c.

Followed by anodal closing contraction, a. c. c. and this

Followed by anodal opening contraction, a. o. c.

The two latter may change places and still be classed as normal, but if the anodal closing contraction appears first, we then have what is termed the reaction of degeneration, generally expressed by the letters, R. D.

There is a fourth reaction, the cathodal opening contraction, but it requires too strong a current to produce it, and being painful, I do not attempt it in health. Ordinarily, we will get the three contractions above noted with about the following current strength, that is in healthy subjects:

Cathodal closing contraction, with 2 to 5 milliampéres.

Anodal closing contraction, with 5 to 8 milliampéres.

Anodal opening contraction, with 5 to 8 milliampéres.

These numbers are only approximate, as much depends upon the condition of the subject, whether there be much or little adipose tissue to deal with.

To illustrate the reactions, we will take a case of injury to the arm, the result, we will say, of a railway accident. The patient states that the arm has been rendered useless. Having bared both arms, and the chest of the patient, place a large, well wetted sponge, or other electrode, upon the sternum, connected with the positive pole of the faradic battery, and with the small negative electrode, test the well arm first, noting the coil distance necessary to produce a contraction. Use the secondary coil in such testing. Next test the diseased arm, noting, as Bramwell tersely puts it:

"1. Whether a muscular contraction is produced or not.

2. If a contraction is produced, what is the minimum strength of current required to produce it, and whether the character of the contraction is in any way altered from the normal.

3. The strength of current and the rapidity (whether slow or quick) of the interruptions required to produce the maximum amount of muscular contraction." It is better, in all such cases, to test corresponding groups of muscles, as above stated, so as to compare results.

Next test with galvanic current and note

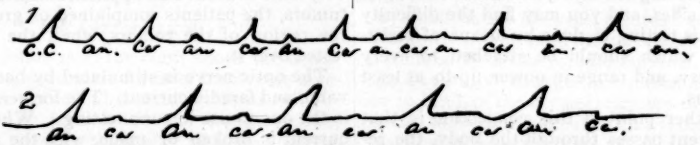
"1. Whether a muscular contraction is produced or not.

2. If a contraction is produced [*a*] what is the minimum strength of current required to produce it; [*b*] the order of the polar reactions; [*c*] the character of the contractions, whether healthy or not; [*d*] the strength of current required to produce tetanus; [*e*] whether the contractions are more easily excited by slow or quick interruptions of the current."

In order to get the most satisfactory reactions, the muscles must be relaxed. If you get conflicting or confusing reactions, and the patient is resisting the current, he must be placed under ether, or some other anæsthetic, when the proper reactions will readily appear.

If, however, you find the normal formula reversed, that is, if anodal closing contraction comes before cathodal closing contraction, you may be assured that there is degeneration, as the reactions of degeneration cannot be simulated.

We are here dealing with a peripheral paralysis, and the reaction of degeneration appears, because the nerve has been separated from its trophic center in the cord. I herewith present a graphic representation of the normal reaction of a nerve under galvanic stimulation.



The first shows the normal reaction, with a quick sharp contraction of the cathodal closing, while the second shows the reversal of the formula, with the anodal closing contraction appearing first, which is the reaction of degeneration.

The following table, taken from Dr. Adams' little work, and compiled from Erb, shows the relationship between the reaction of degeneration, and the histological changes accompanying it, this "reaction of degeneration depending upon a specific histological modification of the irritable tissues, called 'degenerative atrophy,' and this degeneration itself is due to an interference with, or a stoppage of, the peculiar influence of the gray matter upon the nerves and muscles, known as 'trophic' influence."

Seat of Lesion.	Prominent Symptoms.	Electrical Reactions.	Pathological Conditions and Their Location.
Path of impulse from the brain (antero-lateral columns); or the brain itself.	Paralysis. No muscular degeneration.	All normal.	Lateral sclerosis (idiopathic or from cerebral disease).
"Trophic centre" for the muscle, and also the path of impulse from the brain (antero-lateral columns).	Paralysis. Muscular degeneration.	Nerve: Normal. Muscle: Qualitative and quantitative alterations. (Partial R. D.)	Amytrophic lateral sclerosis.
"Trophic centre" extending to multipolar ganglion cell of the anterior horn of gray matter.	No paralysis at first. Muscular (afterwards nervous) degeneration.	Nerve: At first normal; afterwards diminished. Muscle: Qualitative and quantitative alterations. (Partial R. D.)	Progressive muscu-atrophy (of central origin). Bulbar paralysis. Mild acute poliomyelitis.
Multopolar ganglion cell of the anterior horn of gray matter.	Paralysis. Atrophy of muscles and nerves. Abolition of reflex actions.	Nerve: Reaction of. Muscle: Degeneration.	Anterior poliomyelitis. Infantile paralysis. Lead poisoning.
Motor nerve-fibre.	Paralysis. No degeneration.	All normal.	Light form of rheumatic, traumatic, or pressure paralysis.
Motor nerve-fibre and path of trophic influence to muscle.	Paralysis. Muscular degeneration.	Nerve: Normal. Muscle: Qualitative and quantitative alterations. (Partial R. D.)	Middle form of ditto.
Motor nerve-fibre, path of trophic influence to muscle, and path of same to nerve.	Paralysis. Muscular and nervous degeneration.	Nerve: Reaction of. Muscle: Degeneration.	Severe form of ditto.
Muscular fibre.	Pseudo-paresis. Simple atrophy.	Normal, or diminution to maximum excitation.	Muscular wasting in phthisis, etc., and in diseases of the joints. Idiopathic myositis.

There is another and important factor to be considered in all these cases, and that is the resistance of the patient. When a galvanic current is passed through the tissues of the body, it meets with resistance, differing with the portion traversed. The dry epidermis offers the greatest resistance, presenting, according to some observers, as high as three hundred times as great a resistance as that of all the intervening tissues, when a current is passed by percutaneous application, with two layers of the epidermis intervening.

This resistance may so vary upon different sides of the body, as to be very misleading, unless carefully considered. For instance, if, in testing an arm for a supposed lesion, you found that it required a much stronger current to produce a contraction upon one side than upon the other, before diagnosing the injury, test the resistance of the two sides, and you may find the difficulty there. This testing is done by means of resistance coils, which should be attached to every office battery, and range in power up to at least 20,000 ohms.

Still another point in this connection is, that as the current passes through the body, the resistance more or less rapidly declines, due to two causes: the moistening of the dry epidermis, and, according to Prof. Rhoe, the electrolytic arrangement of the molecules in the track of the current. Both have their influence.

In some conditions, I have found cocaine cataphoresis to be of great value in determining whether a lesion was superficial or not. For instance, in a case of severe tic, if cocaine be used upon the anode, and applied to the nerve, and relief be not obtained, the lesion is deeply seated. If, on the contrary, the pain is controlled, the lesion is superficial, and an operation is not, as a rule, indicated.

[Dr. Starr, and Dr. Peterson, of New York, have done much in this direction, especially the latter.]

In testing nerve and muscle, also during treatment, I have noticed some curious phenomena. A case under my care, in which the hand had been amputated, gave, upon tests, and frequently during treatment, sensations of contraction of the muscles of the amputated hand, and the patient complained that the hand pained him, at such times.

BRAIN AND SPINAL CORD LESIONS.

In brain testing, the phenomena are mostly subjective, and yet, as the patient, unless familiar with the reactions, not knowing what to expect, will generally give correct descriptions of what is taking place.

We will take a normal brain, and note some of the reactions produced by the galvanic current, first noting that there are the following methods of brain galvanization: longitudinal, transverse and oblique. The transverse is subdivided into bitemporal, from the parietal prominences, the mastoid processes, and suboccipital. In a normal, healthy brain, no unpleasant sensations are felt, more than a possible slight dizziness, when a current of from 3, or even 5, and in some instances more, ma. are passed through it, in any direction. By reversing the current, without shock (which should always be avoided), the molecular arrangement having been disturbed, the sensation of dizziness will most likely be produced.

In anæmia, the tissues being but poorly supplied with blood, the reactions might not appear, but pain would follow. In hyperæmia, however, the effect is very marked, and I have had patients almost fall from the chair, when only a very mild current was applied. In cases of brain tumors, the patients complained of great pain in the region of the tumors, when the electrodes rested over it.

The optic nerve is stimulated by both the galvanic and faradic current. The former, however, is the one to use in such testing. When a feeble current is broken or made, with the electrodes placed transversely upon the temples and in other directions, the optic nerve will be stimulated, and a flash of light be noticed. In some cases of paralysis of the orbicularis palpebrarum, I have noticed that this stimulation was very marked in the affected eye in cases of central lesion. Where the cause was peripheral, the lesion was not particularly marked. In a case of almost complete loss of vision in one eye, the result of a syphilitic iritis, the optic nerve on that side will not respond to any current which I would use upon the head. In the case of a gentleman now under my care, with beginning sclerosis of the brain, I find that at times, especially after prolonged mental exertion, he can bear but a very mild current through the mastoid region, say 1½ ma., or longitudinally, without considerable pain being experienced. He is subject to sudden attacks of epistaxis, which afford more or less relief. Now while this patient cannot bear the moderate currents alluded to, when comparatively small electrodes are used, yet with a positive helmet covering the entire head, 20 ma. may be given with comfort and benefit, the negative being at the feet.

The use of the static spark in diagnosis, is at times essential. When a nerve will not respond to either the galvanic or faradic current, it will sometimes do so to the static spark, thus showing a continuity, not otherwise demonstrated. The reason for this is, that the franklinic current possesses such an enormous voltage, which penetrates deeply, affecting areas that the other currents fail to sufficiently stimulate. Obviously this current is not available for use about the

head, in diagnosis, but must be confined to the trunk or limbs.

The reactions of the auditory nerve to the galvanic current, as formulated by Brenner, are painful to produce, and few patients will be found, who are willing to submit to them. I seldom attempt them. In some cases of tinnitus aurium, the tinnitus will subside entirely during the passage of a mild current through the auditory nerve, and in such patients I give a very favorable prognosis.

The effect of the electric current upon sensory nerves differs from that upon motor nerves, in that the sensory nerves are stimulated by a continuous flow of either current. With the galvanic, a sensation is felt with a weaker current with ca. cl., an. cl., and an. o., than with a continuous flow, in this respect behaving precisely as do the motor nerves.

RECAPITULATION.

When a lesion is in the cord, above the dorso-enlargement, as in some forms of transverse myelitis, all the nerve and muscle reactions will be normal, for the parts below the trophic centre, except that possibly there may be some increase in readiness of response to electro-stimulation. If the lesion involves the dorso-enlargement, of course there would be the reactions of degeneration.

If the lesion be in the basal ganglia, or in the hemispheres above, there will be no change in the normal formula, unless the disease, in its progress, produces changes in the cord, thus affecting peripheral nerves.

In a hemiplegia, the result of a clot in the corpus striatum, there will be no change in the reactions, except that in some cases, the muscles respond more readily than the normal muscles, to both currents. In other cases, the reactions are simply normal, but in still other cases, there may be a quantitative decline, due merely to the degenerative changes in nerve and muscle.

In uncomplicated lateral sclerosis, the reactions are all normal. I have a case of lateral sclerosis under my care, of eight years standing, and specific in origin, which, when first tested, some six months ago, showed partial reaction of degeneration, but now the normal formula has been re-established.

In amytrophic lateral sclerosis, there will be both qualitative and quantitative changes in the muscles, or partial reaction of degeneration.

In anterior poliomyelitis, infantile paralysis, and in lead palsy, we have the reaction of degeneration.

It will also be found in peripheral paralysis of traumatic, rheumatic, neuritic or diphtheritic origin. It is absent in all cerebral, hysterical, myelitic and purely myopathic paralyses.

In cases where the reaction of degeneration is limited to a definite peripheral neuro-muscular area, the probabilities are in favor of the diagnosis of a peripheral lesion. When the phenomena of R. D. are observed over a larger area, a central (spinal) origin of the paralysis is rendered probable.

In light forms of rheumatic, traumatic, or pressure paralysis, the reactions will all be normal. In the middle form of these affections, qualitative and quantitative changes appear, and there is partial reaction of degeneration. When the severe form appears, we then have complete reaction of degeneration, or the normal formula completely reversed.

In muscular wasting, or simple atrophy, such as in phthisis, etc.; in diseases of the joints, and in idopathic myositis, the reactions are normal, or the diminution is to the maximum of excitation.

By quantitative changes, is meant an increase, a diminution, or a total disappearance of electrical irritability to one or both currents.

By qualitative changes, are meant a modification in kind, of the normal reactions of nerve and muscle, to electric currents. This is the so-called "reaction of degeneration."

There is a third, or a mixed change, or a combination of quantitative and qualitative variations of irritability.[1]

The histological changes shown in the preceding table, explains the phenomena of the reaction of degeneration. There is a solution of continuity, and a consequent inability to transmit impressions. Gessler, in his researches upon cold-blooded animals, seemed to prove that true R. D. was entirely due to muscular degeneration, as, while in these animals complete nerve degeneration occurred, muscular degeneration as well as R. D. were absent.

There is much yet to be learned regarding brain diagnosis, and I hope at some future time to present the result of some investigations that I am making in this direction.

2005 Arch St., Philadelphia.

SOCIETY PROCEEDINGS.

Medico-Legal Society of Chicago.

Mr. President and Gentlemen of the Society: Instead of presenting the clinical symptoms of acute arsenical poisoning in the abstract, I have thought a brief description of the symptoms, as observed by myself and others in a series of cases, would be more profitable, and, perhaps, more interesting. By the kindness of Dr. J. E. De Wolf, of Englewood, Dr. Chas. J. Simons and Dr. J. S. Knox, I am able to present the following series of cases:

[1] Bibliography: Liebig and Rohé, Ranney, Adams, Cleavinger, Erb, De Watteville, Bartholow.

THE CLINICAL ASPECTS OF ACUTE ARSENICAL POISONING.

Presented before the Medico-Legal Society of Chicago, Oct. 3, 1891.

By DANIEL T. NELSON, M.D., of Chicago.

The Newland cases you are familiar with in a general way, where the servant girl poisoned an entire family in Englewood. Dr. De Wolf writes me a few notes from memory, as follows:

I responded about 8 o'clock P.M., in April, 1890, to an order coming from the Newland family at about 7 P.M. The entire family, consisting of four members, were sick; the father and mother were in bed. The son, a young man who was out looking for help, soon came in, telling me he had been vomiting freely on the street, and he, too, was obliged to lie down. The daughter, a young lady, was able to be on her feet at this hour, and had not, I think, vomited, although feeling some discomfort in her stomach and bowels. The father and mother had been for half an hour, and still continued, vomiting freely, and complained of pains in the stomach and bowels, and also of dryness of the throat. They seemed not inclined, or not able, to give any explanation of their condition, but learning that they had all sat down together at supper at the usual hour (6 or 6:30) and in their usual happy mood, and finding them thus prostrated, I suspected poisoning, although I could not think it intentional, as it was the first meal prepared by a newly arrived domestic; but learning that she had not eaten with the family, and was missing from the house, added to my fears. Before these facts could be gleaned some time had passed; emetics had been given, and emesis was followed by the free exhibition of demulcent liquids. The symptoms at this point were chiefly those of intense gastro enteritis, but superadded to these came some evidence of arsenical poisoning. In Mr. Newland's case the abdomen became swollen and tender, while the skin was pale and cold, with a clammy sweat, the pulse frequent, small and irregular, the respiration labored, with frequent cramping of the extremities. Mrs. Newland's case differed from that of her husband in that there was a hot and dry skin, with but little if any cramping of the limbs, and with some tendency to delirium, or at least to marked stupor. The other two members of the family presented the same symptoms, but in a less marked degree. In each case anodynes for the relief of pain were given, and the hydrated sesquioxide of iron was given as an antidote to the arsenical poisoning which was suspected.

Two hours after my arrival, Dr. D. T. Nelson was asked for his council, and agreed with me that there seemed to be no need of the stomach pump, as emesis had been so thoroughly effected.

Mr. Newman died about five o'clock of the following morning, and Mrs. Newman at noon of the following day, while the others made a good recovery within a week.

The form of poison used was a kind of arsenical paste, which is called "Rough on Rats," that the servant procured from a neighboring drug store. According to her statement, she put it into the corn, probably after it was cooked. I think no remains of the package could be found. The corn, as I recollect it, was the only dish that was partaken of by all of the family.

From Dr. Simons I was fortunately able to gather a series of cases.

Case 1.—A girl, 18 years old, on account of a love affair, attempted to commit suicide by taking Fowler's solution at bedtime. Dr. Simons saw her within an hour. There were some cramps in the abdomen, with thirst and dryness of the throat. There was purging (but he thinks not from the emetic, which was tartarized antimony) and bloody stools. Hydrate sesquioxide of iron was given as an antidote after the vomiting. She recovered after a week's illness. There was no paralysis.

Case 2.—A family named Fritz; the man was a laborer. There were five in the family, father, mother, and three children from three to ten years old. White arsenic was taken in coffee. They lived in a house by themselves. The family was seen about the house as usual in the evening, and the next morning they did not show any signs of life. The neighbors became alarmed about seven or eight o'clock in the morning, and began to investigate, and found the family all sick. They lived near 18th and Arnold streets, where the County Hospital was then located. Dr. Pitcher, who was county physician at that time, was summoned, but he was not at home, and Dr. Simons was called in. He reached the family about 9 o'clock in the morning, and they were supposed to have taken the poisoned coffee about bedtime, or in the early night, so that it was about twelve hours after taking the poison before the event was known. The mother and two children were dead, but the father and youngest child were still alive. Here arises an interesting question: Why was the father and the babe, which was about three years old, alive? Was it because they had taken a less quantity, or vomited more, or were stronger to resist the poison? The father was not a drinking man. He vomited arsenic, and arsenic was found in his stomach and that of all the others. He was taken as soon as possible to the County Hospital, and his stomach washed out with a pump. He lived two hours. The baby died within two or three hours. When Dr. Simons reached the house, about 9 o'clock, the father was unconscious, but he became conscious before he died. He would not tell who gave him the poison, whether the mother gave it to the whole family, or whether there was an agree-

ment between the father and mother; no one ever found out what arrangement was made. The father had severe diarrhœa and cramps, and suffered greatly. The child vomited without an emetic, and also had severe diarrhœa and cramps. No antidote was given because it could not be swallowed.

Case 3.—A servant girl 23 years old. She had lived with this family some five or six weeks and had always seemed peculiar. She ate Paris green or Scheele's green. She stirred it up with water and drank it, smearing her mouth, her face, her hands, the cup in which she mixed it and the shelf on which it lay. The vomited matter showed what the substance was. Dr. Simons was called in about fifteen minutes after she took it and gave her an emetic; she had vomited previously from the arsenic. There was purging but no cramps. In an hour or two she was taken to Michael Reese Hospital and the subsequent history is not known. She vomited freely the eggs and other demulcents which had been given to her. The stomach was washed out in the hospital but no antidote was given.

Dr. Knox writes me as follows: In 1872, while suffering from neuralgia of the heart, I took through the error of the druggist, one dose of two teaspoonfuls of Fowler's solution, equal to one grain of arsenious acid. About two hours afterwards I had constriction of the fauces, intense burning pain of the stomach, severe colicky pains in the bowels, and subsequently vomiting and dysenteric diarrhœa.

The cause of the poisoning was suspected and I was promptly treated with tablespoonful doses of moist hydrated sesquioxide of iron every fifteen minutes. There was relief in a few hours and no subsequent ill results.

The symptoms as you gather them up, of cold sweats, pinched appearance of the countenance, cold, clammy extremities, and small, rapid pulse are perhaps as marked a series of symptoms as we have, and yet it might be questioned whether these were entirely and positively pathognomonic. Some of these symptoms we get in corrosive sublimate poisoning; the severe bloody vomiting and cramps. You do not get so much, perhaps, of the colicky pains in the bowels, you do not perhaps get such very marked evidence of shock, and yet you will see it. In the only case I have seen of corrosive sublimate poisoning there was quite marked evidence of shock.

Perhaps it will be no credit to myself if I say that I supposed I was poisoned by arsenic while in college. I was working over some small test tubes with the blowpipe, blowing them out with my mouth, and I supposed I had taken some arsenic into my mouth and throat. Not knowing exactly how much it took to produce poisonous effects, I became frightened. I grew pale, had a rapid pulse and thought I had pains in my stomach and bowels, but did not vomit. I was getting ready to take some antidote when my classmate suggested that perhaps it was not arsenic, that he was working with zinc and he thought I was. I soon recovered when I found it was zinc.

The only other case I know of personally was chronic poisoning in which there was extreme weakness amounting almost to paralysis. At first there was ability to walk for months, finally ability to walk with two canes, gradually with one and then without any. It was the case of a celebrated Boston physician, whose name you are doubtless familiar with, Dr. Bumstead, a man who has been celebrated for years as an author of venereal diseases. He was poisoned apparently by arsenic, as he supposed from wall paper.

Perhaps I need not speak of some very self-evident things, that Fowler's solution is perhaps the worst form of the poison to take; being in solution it is rapidly absorbed and not easily thrown off by emetics or otherwise, or reached by antidotes. In some regions it is a common domestic remedy, and known as the "ague drop," and is liable to be used as a poison accidentally, if not intentionally. Fortunately the odor of lavender gives it a specific and peculiar odor so that it may be detected, and if vomited the odor will lead the physician to suspect what he has to deal with.

Another question might be raised, and I suggest it for your discussion: Whether there is arsenic enough discharged from smelter chimneys to be of injury to persons, animals or foliage. You will sometimes notice from the smelter works at 40th street and Armour avenue, the peculiar sweet odor of arsenic. In looking over some books, I noticed that some one had prescribed Fowler's solution in two teaspoon doses for snake bite, and had been very successful in making the patient vomit. The doses were given every half hour until the patient was relieved. I was wondering which was most likely to kill, the snake bite or the remedy, but the patient is reported to have rapidly recovered, so we suspect the Fowler's solution was thrown off by the vomiting.

One of the patients you notice was said to be comatose; the question where the coma comes from is interesting. In some cases bloody albumenous urine is reported. Is the coma the effect of the poison on the kidneys? Is it uremic coma?

I did not intend this to be anything like a full presentation of "the clinical aspects," but I thought as I was able to gather together some of these cases, if I could get something of a series, it would be perhaps more interesting. I have not touched upon the treatment, as I thought that belonged to another department.

SPONTANEOUS RECOVERY IN ACUTE ARSENICAL POISONING.

Read before the Medico-Legal Society of Chicago, October 3, 1891.

BY HAROLD N. MOYER, M.D.

Almost every poisonous substance is characterized by some fairly pathognomonic symptoms, with the exception of arsenic. It belongs to the class of intestinal irritants, the symptoms of which may be closely imitated by any simple inflammation of these parts. We lack the characteristic symptoms presented by opium, belladonna or strychnia, so that a certain diagnosis of arsenical poisoning is difficult or impossible without the aid of a chemical analysis. The symptoms and pathological appearances in acute arsenical poisoning are fairly constant, and yet there is an occasional case in which there is such a wide divergence from the typical picture that there is great liability to error. With these uncertainties clearly before us, we should be very careful in advancing a dogmatic opinion.

The average fatal dose of arsenic is well known, but the literature of medicine contains many cases where spontaneous recovery has taken place after the ingestion of a quantity many times greater than a dose that commonly proves fatal. It is apparent that the factors governing these cases are exceedingly various. The resistance of the patient may be greater than usual; a dose, granting that it is all absorbed, may be eliminated in one case, that in another would prove fatal. Again, the rate of absorption may vary. If the arsenical preparation is relatively insoluble, it may be so long in entering the circulation that the greater portion is either vomited, or passed off by the bowels in consequence of the violent peristalsis produced by the drug. As a matter of fact, it is only exceptional that recovery takes place when these violent symptoms are present. Recovery has, however, been noted after the taking of enormous quantities. Tidy refers most of these cases to that class in which the poison is taken upon a full stomach. As a consequence, the great bulk of the drug is rejected with the food in the first efforts at vomiting. It is probable that this is the explanation in most of the cases where spontaneous recovery has taken place after exceptionally large doses. It would be hazardous to deny the possibility of spontaneous recovery even when the arsenic has been administered upon an empty stomach, but we may at least say that it is highly improbable. Any one who has ever examined a stomach containing a considerable quantity of arsenic, must have noticed the closeness with which the powder adheres to the mucous lining of the organ. The healthy empty stomach always contains a small quantity of mucus, and this serves to glue the powder to the stomach walls, so that with violent vomiting it is gotten rid of with difficulty, or not at all.

The following case is one of peculiar interest, and is, so far as I know, the first time the question of spontaneous recovery from arsenic has been directly raised in a court of law.

The facts are briefly as follows: A man was charged with the attempted murder of his child, the motive alleged being a desire to inherit considerable property belonging to the latter. The testimony brought out at the trial showed that the child was 3½ years of age, and that it had always been of delicate health. The night preceding the alleged poisoning, the child was taken vomiting shortly after eating a hearty supper. A physician was called in, and made a diagnosis of dyspepsia and bronchitis. The boy vomited once or twice during the night. At 15 or 30 minutes after 6 the following morning the father gave him a drink of water, in which it was supposed he had placed the poison. At 15 minutes after 7 a woman who had charge of the boy came into the room to dress him. He then complained of feeling ill and began to vomit. The nurse noticed that the tongue was covered with a thick green coat; the vomited matter was also mixed with a greenish substance that stained the towel upon which they were caught. A subsequent examination of these cloths showed the greenish matter to be Paris green, the quantity recovered amounting in all to about 2 grs. (Regarding the quantity of Paris green, there is a discrepancy between the testimony of the physicians who examined the towels and the chemist who made the tests. The former say that at least ½ teaspoonful would be required to produce the amount of staining which they saw. We may disregard this, however, as the smallest quantity stated, 2 grs., is amply sufficient to cause death in a child 3½ years old.) A servant also noted and testified that the child vomited a greenish substance. As soon as the vomiting began a physician was summoned, who reached the house at 8:15 A.M. On the strength of the statements made to him he prescribed an antidote and an emetic, the latter acting freely. This physician refused on the stand to state that he believed the symptoms were due to arsenical poisoning, as he thought they were too mild. A second physician, who saw the child at 10:30 the same morning, also refused to state that in his opinion the illness was caused by arsenical poisoning. After the effects of the emetics passed off, there was no special disturbance of the child's health, no vomiting, purging, inflammation or prostration.

Certain facts in the above account show that this case is one that must be classed among the spontaneous recoveries, granting that a fatal dose of arsenic had been administered as alleged. It must also be placed among the unusual ones, as the poison was given on an empty stomach. At least three-fourths of an hour elapsed from the

latest time when the poison could possibly have been administered before the child began to vomit, then he was given some milk and he vomited again. One hour later a physician arrived and administered an emetic, but at this time no greenish matters were discharged.

The question naturally presents itself, and it was one upon which we were asked for an opinion, "Was the Paris green administered as alleged?" If we assume that it was given, then we affirm the possibility of recovery upon an empty stomach, and without the use of antidote or emetic. Granting this possibility, the additional fact presents itself, in this case, that the child was not ill after this severe dose of arsenic. Assuming that the vomiting was caused by the poison, sufficient must have been absorbed to cause marked irritation of the stomach. Is this possible in view of the fact that there was no purging, inflammation or prostration three hours after the administration? Beck mentions a case of spontaneous recovery after Paris green poisoning in a young boy. Recovery took place only after a prolonged illness, with severe prostration. It is a general experience that recovery after acute arsenical poisoning, if sufficient time has elapsed for vomiting to have occurred from action of the drug, is exceedingly slow. The patient is often prostrated for days, and sometimes death takes place long after the administration of the fatal dose.

In view of the very great uncertainty that surrounds the subject of acute arsenical poisoning, we can hardly deny that arsenic was administered in this case, and yet a careful consideration of all the facts throws at least a reasonable doubt on the testimony. An opinion was accordingly given that, while the facts as brought out in the testimony were not inherently impossible, they were in a high degree exceptional.

A very ingenious explanation was offered by one of the medical witnesses. He would account for the spontaneous recovery on the theory that, as the child was suffering from bronchitis, it must have swallowed a considerable quantity of mucus during the night. This he thought would act in much the same way as a quantity of food in delaying absorption of the poison.

434 W. Adams St.

CHEMICAL CONSIDERATION IN POISONING.

Presented before the Medico-Legal Society of Chicago, Oct. 3, 1891.

By C. D. WESCOTT, M.D.

I am very sorry, as I know you all are, that Dr. Haines cannot be present to-night. From a little talk we had late last evening, I know that he would have contributed some very interesting matter, although he had been unable, from lack of time, to prepare a paper or even an abstract. However, he asked me to bring up one or two points which his experience has brought to mind. One of these points has already been raised by Dr. Hektoen, that is, the fact that the embalming fluids in common use by undertakers often interfere with the detection and punishment of crime. Professor Haines has been engaged as chemical expert in at least five cases where there seemed to be abundant evidence of murder by arsenical poisoning, in which the fact of arsenical fluids having been used in embalming made it impossible to convict. And in another case, an innocent person came very near going to the penitentiary because of the accidental contamination of a stomach contents by arsenic from an embalming fluid. It may be well for me to recite the principal details of some of these cases.

In one case a man had made a will, bequeathing his wife a certain portion of his property; he determined to change the will, and in such a manner that she would be a hundred thousand dollars worse off; and so announced to her. There seemed to be abundant evidence to convict her of poisoning her husband with arsenic. Organs from the body of the man were submitted to Professor Haines for analysis and he found arsenic in the liver, stomach and contents of the stomach. And when these facts were brought before the woman and she was asked to plead guilty, she boasted that they would cut no figure, that she herself had ordered the undertaker to embalm the body and put all sorts of chemicals in it.

In another case, a maiden lady was found dead in the house of some people with whom she was living. It was learned that she had made a will bequeathing certain property to these people and that they had become aware that she intended to change the will to their disadvantage. Arsenical poisoning was suspected, and Professor Haines found in the stomach contents traces of arsenic. The stomach as an organ was not submitted. For some reason the body was re-examined and it was found that the stomach had been carefully washed out and that the abdominal cavity contained fluid; it was learned that the undertaker had been there in the meantime and put embalming fluid into the abdominal cavity, which upon examination was found to be arsenical. There was evidence to show that the people in the house had opened the body and washed out the stomach clean, still these people were not convicted of the crime because it could not be proven that the arsenic which Professor Haines had found in the stomach, was administered to the patient before death, because of the presence of the embalming fluid.

There is a very interesting chemical fact in connection with the other case in which an innocent party came near being punished. A woman suddenly died and somebody suspected that the husband had committed murder. There were some symptoms of arsenical poisoning, and the

stomach and other organs were submitted to Professor Haines for examination. A very small quantity of arsenic was found in the stomach contents, but Professor Haines had a feeling that it was not a case of arsenic poisoning, and he questioned the Doctor very carefully as to the possibility of any contamination of the stomach by arsenical fluid. The Doctor insisted that it was impossible. To make a long story short, it was found that the Doctor, when he removed the stomach contents, had asked the undertaker at whose place the body lay, for some sort of jar to put these contents into. The undertaker gave him a jar which he said had contained sulphate of zinc and nothing else; it was washed in a dark room several times with running water and was supposed to be clean. But it was afterwards ascertained that after the jar had been emptied of sulphate of zinc some arsenical embalming fluid remained in it for a short time. The interesting chemical fact in this connection is that although this jar had been thoroughly washed with water it did contain a little arsenic which had contaminated the contents of the stomach. To demonstrate how this was possible, Professor Haines experimented by securing some of the undertaker's embalming fluid and allowing it to stand a short time in a jar, when the characteristic crystal of arsenious oxide gathered around the sides. The fluid was poured off and it was shown that water could be repeatedly poured in and out of the jar without dislodging the arsenic.

As has already been mentioned this evening, there should be some legislation in regard to this matter of embalming fluids. Arsenical fluids are not necessary, in fact it is not necessary to embalm bodies with any substance which is a common poison, or which occurs commonly in suicidal cases or in murders. A mixture of alcohol, glycerine and water has long been used at Rush Medical College for preserving bodies for the purpose of dissection, and it has been found very efficient. Very few people suicide with alcohol, and no one has been murdered with alcohol to my knowledge; such a fluid therefore would not interfere with the detection of crime. If salicylic acid were added to this mixture, it would be even more effective and no less desirable as an embalming fluid.

Another point which Professor Haines suggested is that there is no absolute test for arsenic, that is no single test, and I personally know that Prof. Haines never testifies against a man accused of murder by arsenic without testing and retesting by the various established methods, and told me last night that now he never makes an examination in a case of poisoning without at the same time carrying on a blank test, even going so far as to use an organ from a recently killed animal or from a deadhouse, such as he is examining for poison. It is not enough that he uses chemicals which he is sure are absolutely pure, it is not enough that he keeps those chemicals constantly under seal in his laboratory, but even though he is sure he has pure chemicals and clean utensils, he makes these parallel tests in all cases. This illustrates the fact spoken of by Dr. Hektoen, that only the most careful and competent persons should be entrusted with such examinations. Only men of such care and skill and conscience should give such evidence in such cases. It should be illegal to use any poisonous embalming fluid, and I hope this Society will take some action in regard to the matter with a view to securing legislation on this point.

Another point I would suggest is, that in spite of the great number of cases of arsenical poisoning, it is a wonder there are not more, because of the universal distribution of arsenic in a great many forms and the ease with which it can be obtained. The common flypaper used in so many houses, the black paper placed in dishes of water, is impregnated with arsenic, and cases of poisoning have occasionally been reported of children drinking this water.

(*To be concluded.*)

THE MORPHOLOGY OF BREAST MILK AND THE NUTRITION OF THE CHILD.—(Ivanoff. Thèse de Saint Petersburg, 1890.) An extensive study of this subject leads the author to the following conclusions:

1. The cellules of colostrum are of epithelial origin.
2. In multiparæ colostrum changes to milk more rapidly than in primiparæ.
3. Puerperal diseases retard the disappearance of the colostrum corpuscles.
4. These corpuscles reappear in the milk after ten months of lactation, and when the infant is only partly fed from the breast.
5. The free hyaline corpuscles, as well as those which are enclosed in the fatty globules, form a constituent of normal milk at a certain period of secretion.
6. Good health, good nutrition, and youth in the mother give a milk richest in fatty globules of large size, as is also true of the cellules.
7. The last portion of milk taken at a feeding holds fewer globules, and these of smaller size, than the first portions.
8. The estimation of the nutritive quality of milk should be based upon the number of fatty globules; and secondarily, upon their size, the quantity of cellular element, and, finally, upon the quantity of granules.
9. Milk which contains a very large number of fatty globules (more than 3½ per cent.) is not well borne by very young iufants.
10. Milk, the globules of which are large, is less nutritive and less well borne.
11. The maximum of daily increase of weight of the child is produced by milk which contains a mean quanity of fatty globules of medium size (27.7 grams daily).
12. The milk which contains few fatty globules gives little increase of weight (16 grams daily); and the same is true if the fatty globules are in too great quantity or are too large (19 grams daily).
13. Women who are thin and young in general are the poorest nurses, often making the children dyspeptic and giving them a mean daily increase of weight of only 11.5 grams.—*Annals of Gynecology and Pædiatry.*

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SATURDAY, NOVEMBER 14, 1891.

THE GASTRIC JUICE IN BRIGHT'S DISEASE.

BIERNATSKI has recently investigated the gastric juice in Bright's disease, by the modern methods of research, and reported his results in *Vratch* (1891, Nos. 12, 18, and 21), of which *La Province Médicale*, October 10, 1891, gives an abstract. He selected twenty-five cases of Bright's disease, uncomplicated by disease of other organs, and particularly those cases which had not presented any digestive troubles, and which were not ascitic. The cases were all in the earlier stages, oliguria and œdema having been present only one, two or three weeks, and in age were between 25 and 40, with a few over 50. He gave trial meals, and determined the HCL qualitatively by the GUNZBERG test, and quantitatively by the SJOEQUIST method. The biuret reaction was used for peptones, UFFELMANN'S test for lactic acid, and the total acidity determined by decinormal solution of soda. The peptic power was determined by artificial digestion of albumen cubes, and the lab-ferment and lab-zymogen investigated by the methods of KLEMPERER and BOAS.

From this it will be seen that his methods were sufficiently complete to make his results valuable.

From his observations this general result was obtained: *The intensity and duration of the gastric secretion are diminished in nephritis.*

There were always great variations in the quantity of free hydrochloric acid, which was more or less diminished or entirely absent. After the EWALD trial meal the free HCL was rarely more than 0.02 per cent. to 0.04 per cent. The total acidity, however, was frequently above normal, notwithstanding the diminished amount of HCL. While peptonization always occurred, it was always slow or incomplete, notwithstanding the addition of free hydrochloric acid to the gastric juice. The lab-ferment and lab-zymogen were always deficient, and lactic acid was never present in large quantities.

The quantity of free HCL present is usually, if not always, below normal, but it is subject to great variations. A very direct relation seems to exist between the renal secretion, and the secretion of hydrochloric acid. Oliguria and œdema diminish the secretion of hydrochloric acid. In acute nephritis the secretion of hydrochloric acid very quickly returns to normal when the renal symptoms disappear, but in chronic nephritis the acid secretion does not reach a normal amount as long as there is albumen in the urine, even after the disappearance of œdema and oliguria.

In general, it was found that the longer the disease had continued, the more marked was the disturbance of the gastric secretion. The influence of uræmia was studied only in mild cases, and these showed a diminution in the hydrochloric acid secretion, greater than could be accounted for by the oliguria or œdema present, or by the duration of the disease.

From the foregoing, it may be inferred that a diminution in the secretion of hydrochloric acid occurs in renal incompetence, and is proportioned to the degree of the renal incompetence.

It is to be regretted that BIERNATSKI did not determine the relation of hydrochloric acid secretion to urea excretion, and thus bring his work into closer relation with that of DR. BOND, of Richmond, Ind.

It was found that the secretion of pepsin did not bear as direct a relation to the variations in the renal disorder as did the secretion of hydrochloric acid. In general it was found that the complete absence of pepsin is more frequent in nephritis, either acute or chronic, than the complete absence of free hydrochloric acid. This last observation is particularly valuable when it

is borne in mind that direct investigation of the stomach contents has shown that in the great majority of primary dyspepsias, the peptic strength of the gastric juice is not impaired.

Notwithstanding the diminished amount of gastric secretion, very slight evidences were found of any abnormal fermentations occurring in the stomach, which is due, according to the author, to the unimpaired mobility of the stomach.

The causes of the gastric disorders in nephritis are certainly complex, but it is probable, as the author suggests, that one of the factors concerned is the depressing effects upon the gastric mucosa of the waste products which have failed of elimination by the kidneys. Under these circumstances the gastric mucous membranes may possibly assume an excretory rôle. Poisons passed in this way, which would at first cause functional disturbances, would in time lead to the production of anatomical lesions, particularly atrophy and fatty or amyloid degeneration of the mucosa.

The changed chemical composition of the blood is no doubt another factor in the modification of the gastric secretion. BIERNATSKI attributes the origin of pepsin to the albumen of the blood, and holds the hypo-albuminosis of this fluid responsible for the diminished secretion of pepsin. This latter statement can hardly be accepted without great reservations.

By way of treatment the author suggests the use of peptonized milk, and the administration of lime salts, because of the absence of lab-ferment. Hydrochloric acid lemonade diminishes the unpleasant sensations of the patients, and at the same time regulates the alvine evacuations by stimulating peristalsis. Moreover the hydrochloric acid diminishes the intestinal putrefaction, which is singularly exaggerated in this disease, as the author has shown by urinary examinations.

DELIRIUM IN PNEUMONIA.

A recent observation by CASTELAIN (*Archives Médicales belges*) seems worthy of some attention. His observations relate to the delirium which commences just before the crisis, and lasts for several days thereafter. While not ignoring general conditions, alcoholism, debility, the condition of the heart, and circulation, of the brain, and nervous system, of the kidneys, and other organs, he has directed especial attention to the condition in the lungs. During the period of complete hepatization, the lung is impermeable to air; the exudation is abundant but coagulated and compact; the alveoli are filled with fibrine, and young cells, mixed with red corpuscles. Next comes the period of liquefaction, and absorption of the great mass of the liquefied products.

CASTELAIN'S observations at this period of the disease, lead him to the following conclusions:

1. The appearance of the delirium coincides with the beginning of the period of liquefaction, and is its first indication.

2. The curve of the delirium is parallel with the curve of liquefaction, and of the abundance of the exudation. The delirium increases during and after defervescence of the fever, in proportion as the râles become more moist and more numerous, and as they extend over a greater area. The delirium diminishes and disappears, little by little, in proportion as the fine râles become less numerous, occupy a less extensive area, and give place to coarser râles and finally to dry râles.

3. The duration of the delirium is in relation with that of the liquefaction of the great mass of the exudate. If the latter is liquefied rapidly and disappears immediately from the alveoli, the delirium is of short duration, but is more violent than when resolution occurs slowly or in different regions in succession. Delirium may even be entirely absent when liquefaction is slow, or the exudation slight.

THE NON-PERMANENCE OF INEBRIETY CURES EXEMPLIFIED.

The sad death of "FELIX OLDBOY," a literateur of New York City, lately, and a warm defender of the KEELEY "bichloride of gold" cure, is reported. He died from alcoholism in the workhouse on Blackwell's Island. He has only recently been represented in the *North American Review* by a long article setting forth the marvellous effects of KEELEY'S system in his own person and some other very obstinate cases. These cases were strenuously held to be "permanent" cures, but the ink could scarcely have

been dry on the pages of the *Review* before his last lapse into drunkenness took place. So far as this case is concerned, the KEELEY "cure" was worse than a broken reed to lean upon, since this unfortunate inebriate was induced to ignore and despise the more legitimate measures of relief. The glamour of a false "permanence" misled him, and has probably hastened his final and fatal lapse. This is not said as being peculiar to the KEELEY cure. It is equally pertinent to every other quackish claim to "permanence" in the treatment of the dipsetic propensity. It is not in the resources of chemistry, we hold, or in the pharmacy of the vegetal kingdom, to produce specifics of that nature. The true secret of KEELEY, and every other pretender of his class, who exert any prohibitive influence over the lovers of toxicants, resides in the power of the mind — the superiority of will power — and can properly be included under the head of "mind-cure" masquerading in the garb of drug-treatment. In view of the above, what will be the prognosis in the case of KEELEY? His bubble has burst suddenly in the sight of the whole world, but his decline will not, therefore, or of necessity, be immediate. He may still continue to have a following, more or less noisy and enthusiastic, but his end draws nigh. We have seen just such cases as his, and the history of medicine tells of many others like him, and almost without exception this has been the rule: exposure of fraud eventually brings about its downfall, but it is seldom an immediate or a very rapid decline. Sometimes a fraud shows a considerable vitality, but this is not the rule, when the true facts in the matter have been laid bare.

THE CHINESE FORM OF HIGH DILUTION TREATMEMT.

The *North China Medical Journal* is responsible for the following paragraph about an infinitessimally potential treatment employed at the antipodes; it is not improperly called "The Brass Ass Cure." That journal states that a traveler from Pekin says "that he saw a method of cure which may be new to some of our readers. In a temple outside one of the city gates is to be found a brass mule of life size, supposed to have wonderful healing properties. Patients suffering from every imaginable disease seek this temple to obtain a cure. The method pursued is as follows: Supposing you suffer from sciatica, you go with all speed to this famous temple, and having discovered the particular part of the brass mule corresponding to the painful region of your own body, you first rub the animal a certain number of times and then with the same hand shampoo your own disabled member, and then—well, then the pain goes. The special feature of this method of cure is its delightful simplicity. Is your tooth aching? Just scrub the mule's teeth and afterward your own, and, *voilà!* the cure is complete. Have you an ulcer of the cornea? Pass the tips of your fingers to and fro over the particular eyeball of the mule, and then with well-regulated pressure rub repeatedly the afflicted eye. The mule has unhappily lost his sight during the many years he has been engaged in his benevolent work, the eyeballs, we are told, having been gradually worn away as the result of constant friction, until now you have only the empty orbits to operate upon. The animal is patched in all directions with fresh pieces of brass put on to cover holes produced by the constant friction of eager patients, and a new, perfectly whole mule stands ready at hand awaiting the day when his old colleague, having fallen to pieces in the service, shall give him an opportunity of likewise benefiting posterity."

The reader of the above will recognize that there is in it a reminder of the *similia similibus* principle as well as that of minute dosage.

EDITORIAL NOTES.

THE KÖRÖSI PRIZE.—Dr. Joseph Körösi, of Budapest, has offered the sum of $300 as a prize for the best essay on the objects of demography and its progress in the chief countries of Europe and America. The competition remains open until January 1, 1894. The award will be made at the opening meeting of the next International Congress of Hygiene and Demography, at Budapest in 1894. The essays may be in either the English, French, German or Italian languages.

THE PISTOJA POWDER REMEDY FOR RHEUMATISM AND GOUT.—A somewhat famous remedy in Italy for rheumatism and gout is the Pistoja powders, so called because sold formerly as a proprietary remedy by the monks of the town of

Pistoja. It is now no longer a secret medicine, thanks to the governmental regulations which at the present time forbid the sale of patent remedies, the composition of which has not been revealed to the proper officials. The formula of the Pistoja powder is said to be:

℞. Colchicum corms, 2 parts.
Bryonia root, 1 part.
Betony, 5 parts.
Gentian, 1 part.
Chamomile flowers, 1 part.

To be finely pulverized. Mix. Dose at first not to exceed 10 grs.

The presence of colchicum explains why it is that untoward results have been experienced by the non-professional prescribing of this remedy, which was alleged by the monks to be harmless.

THE ANNALS OF HYGIENE for November has taken one of our five line items and given it the very appropriate title of "The Potency of Malnutrition," for which title we extend thanks. Although it was only put at the end of a page to fill space, it was editorial matter.

DOMESTIC CORRESPONDENCE.

LETTER FROM PHILADELPHIA.

The health of the community at the present time is very good. There was a report that diphtheria was prevailing in the western part of the city a few weeks ago, and pending an investigation, one of the public schools was ordered closed by the Board of Directors. It was found that there was an unusual number of cases of catarrhal sore-throat and tonsillitis—possibly an aftermath of the grippe, or due to weather-changes, but only one or two well-authenticated cases of diphtheria could be discovered. The school house was examined by Dr. J. Howard Taylor, physician of the City Board of Health, by whom it was declared to be in good sanitary condition; and it will, therefore, be re-opened at once.

The quality of the water-supply of Philadelphia has for some time been rather severely criticized in the public prints; but there is room for the suspicion that at least some of the advocates for better supply were not entirely disinterested in the matter; their plea was not so much for a better water supply as it was in favor of a certain specific plan, which if adopted would result in the expenditure of a large amount of money on the part of the city to the great pecuniary advantage of themselves or their clients. In spite of the obvious fact that the mortality-rate of Philadelphia is below that of other large cities, and the additional fact that the Schuylkill water has been repeatedly analyzed and pronounced good, even better in quality than the drinking water of New York, Boston and other American cities, the impression seems to have become general that Philadelphia has a seriously polluted water-supply; whereas the truth is that special attention has been given this matter of late years by the city authorities; and since the construction of the intercepting sewer and the immense subsiding reservoirs in the East Park, and the abolition of some evident sources of contamination, the drinking water of the city has been not only abundant, but of very good quality. The City Councils have just received a report of a sub-committee, appointed to compile a statement from the reports, papers and documents of the Water Department, concerning the water supply of the city, with a digest of their conclusions, acting with the Mayor and the Director of Public Works. The special object of the investigation was to obtain a well-matured decision as to the nature, character and cost of the system to be adopted in future, and incidentally to expose any defects or deficiencies in the present plan of supplying the city with water. The report is full and elaborate; and while it refrains from any definite recommendation, it declares very positively that there exists no necessity for the present generation to take into consideration any other source of supply than the Schuylkill river, as this is shown by all reports; the minimum flow, in case of the heaviest draught in any year, being 225,000,000 gallons in 24 hours, while the maximum over 4,500,000,000 gallons, in the same time. It is advised, however, that action be taken at an early date to prevent useless waste. In regard to the purity of the water, the report claims that it has been clearly demonstrated that if water be taken from Flat-Rock dam, a point above Manayunk, the water will be purer, and the purity could be still more improved by obtaining the city's supply from the Norristown dam, about fifteen miles from the city, the water being brought down by conduits. The statistics of the Water Bureau show that the water from these points is not surpassed in purity by that from any other site along the Schuylkill yet suggested. To make a greater improvement in the quality of the water will bring in the question of filtration, one of vital importance which cannot be ignored, and the argument is made that no permanent relief can be afforded without filtration facilities of the most approved character. This report is now before Council for discussion. A plan has already been adopted for locating a new reservoir for subsiding purposes near the Falls of Schuylkill, and it is probable that in its construction the recommendation of the Committee, with reference to a system of filtration, will be carried out.

The medical schools report progress. At the University of Pennsylvania, the Freshman class is larger than last year. The Faculty, having already a three year graded course, are now agitating for a fourth year to the medical department. Some time ago Professor Pepper announced that such an extension of the course would be made in time, but that an endowment of $250,000 and a guarantee fund of $20,000 per annum for five years, would be necessary. Dr. Pepper offered, himself, $50,000 toward the endowment and $1,000 per annum toward the guarantee fund. The rest of the money necessary has not yet been obtained, although the subscription is progressing well, so that it is confidently expected that the new course will go into operation in the Fall of 1893.

Students who enter this year are allowed to choose the four year instead of the three year course, and some ten or twelve, thus far, have done so. The new School of Hygiene at the University of Pennsylvania, founded by the liberality of Mr. Henry C. Lea and others, will be opened about February 1st, 1892. The Laboratory building, in which it will be located, is rapidly nearing completion, and is already praised for its beauty and its ingenious construction. It is very clear that the course is to be eminently practical. Every part of the building is a hygienic object-lesson; all the most approved methods of heating, lighting, draining and ventilating are to be tested by actual use. One room has six varieties of steam radiators, arranged so that the efficiency of each, and others if necessary, can be known by accurate measurement. Another room exhibits three systems of ventilation. All sorts of traps and water-closets will be tested in the building. All pipes for drainage, hot and cold water, steam and gas, have everywhere been left bare; each system has its own color, so that it may be readily traced. In many of the laboratory fittings, there are new features, especially adapted to the novel work to be done. The construction has been continually under the supervision of Dr. John S. Billings, who will be the Director of the School, and it appears certain that nothing which could add to the efficiency of the course has been omitted. Besides the course in Practical Hygiene, there will be an elementary course in bacteriology, commencing February 1, 1892; and an advanced course commencing April 2, each lasting eight weeks. These courses are intended to be practical and will include investigations of water, air and soil, the study of pathogenic bacteria, microscopic technique, culture media, protective inoculation and the preparation of vaccines, also details of disinfection, antisepsis, etc. Dr. A. C. Abbott, recently Assistant in Bacteriology and Hygiene in the Johns Hopkins Hospital in Baltimore, has been appointed First Assistant in the Laboratory of Hygiene, and applications for information or admission should be addressed to him at the University of Pennsylvania.

The Medico-Chirurgical Hospital during the summer has been remodeled. Two floors containing rooms for private patients have been added, and a new front of Pennsylvania granite, of appropriate and impressive design, has been built on the street-line. By these improvements, now approaching completion, the capacity of the hospital will be nearly doubled. The wards have been enlarged, private rooms added, and the structure raised from a four-story to a six-story building. The opening takes place with public ceremonies, on November 10. The Medico-Chirurgical College, both in its medical and dental classes, reports good attendance, somewhat in excess of last year at the corresponding period. Prof. Ernest Laplace has a complete bacteriological and pathological course, with excellent facilities for instructing students in pathogenic bacterial culture and microscopic work.

The election of Dr. Jas. C. Wilson to the chair of Practice at the Jefferson has given general satisfaction to the alumni and students, who are also gratified by the arrangement by which Prof. Da Costa continues his medical clinics, although now only Emeritus Professor of Practice. Prof. Da Costa will also give his usual clinical lectures at the Pennsylvania Hospital this winter on Saturday mornings. In spite of the loss of Prof. Barthlow, and the uncertainty as to who would succeed Prof. Da Costa, the Dean of the College, Prof. Holland, states that the class is about 500, which is quite up to the average number for the last ten years. It may be stated that all our colleges now require evidences of preliminary preparation, and all have a compulsory three years' course. This, taken in connection with the previous statements about the size of the class at each of our schools, should prove to those colleges in other parts of the country, which are fearful of advancing their requirements, that the profession is ready to support them. In connection with the Jefferson, it is an open secret that committee meetings have been held lately, and much debate indulged in concerning ways and means, and details of site and construction for the contemplated new buildings; it being said that the most approved plan will locate the new structure on Broad street, south of Walnut.

So far, this has been by far the most prosperous year in the history of the Philadelphia Polyclinic. All the departments are active, the clinical material which is used in teaching is abundant and varied, and the classes are much larger than they have ever been. The branches to which students are most attracted are, of course, gynecology and general surgery; although the departments of clinical medicine, neurology, diseases of the chest, throat, nose, ear and skin, are all doing active work. During the current month fourteen laparotomies, and numerous other surgical operations, were performed in the hospital before the class. On October 9, Dr. Jackson removed a large ivory exostosis from the orbit. The growth had been noticed for about two years, increasing rather rapidly. The eyeball was pushed forward about 8 mm., and downward 10 mm., but binocular vision was maintained. The exostosis, which weighed 6½ drachms, was removed by drilling holes in the base and breaking the intermediate bone. Its attachment was to the upper, inner wall of the orbit, and the frontal sinuses were opened by its removal. Healing was prompt and uncomplicated, and the sight of the eye was preserved, but there remained a diminishing paresis of the orbital muscles, and some ptosis. Various methods of attack were considered and tried, but the drill was the only instrument that made a satisfactory impression on the extremely hard osseous material of which the tumor was composed.

Dr. Frederick P. Henry, who has been one of the instructors at Jefferson, and was a candidate for the chair of Practice, has been elected to the corresponding chair in the faculty of the Woman's Medical College. Dr. Henry has been for years one of the attending physicians to the Philadelphia Hospital and to the Episcopal Hospital, and Professor of Clinical Medicine in the Polyclinic, and still retains these positions. He is an able pathologist and lecturer, and is a decided acquisition to the Woman's College.

A special meeting of the County Medical Society was

held just after the close of the recent Triennial Congress of Physicians and Surgeons at Washington, in honor of some of the foreign visitors who stopped over in Philadelphia for a brief rest, and to recover from mal de Washington, or Potomac quickstep, which during the late International Congress almost assumed the proportions of an epidemic, especially among the English members. The subject discussed at the special meeting of the County Medical was "Appendicitis." Papers were read by Dr. W. W. Keen, Dr. Joseph Price, and Dr. Thos. S. K. Morton, and a case was presented by Dr. Frank Woodbury, upon which an operation for excision of the appendix had been done by Dr. Thos. G. Morton, five years ago. The discussion was opened by Dr. Wm. Pepper, and was continued by De Forest Willard, Hare, Baldy and others. Mr. Thomas Bryant, of London, one of the guests, while favoring operation, urged the advisability of delay in operating in the majority of cases. Cases should be divided into those which are acute from the beginning, and which require prompt relief, and others, not acute, having a slow and steady progress. The latter begin with a localized pain in the right iliac fossa, accompanied with tenderness and soreness, and less swelling; and according to Mr. Bryant, these can be dealt with satisfactorily without the surgeon's knife. The line of treatment approved by Mr. Bryant would not be that recommended by Dr. Morton, of calomel and podophyllin in frequently repeated doses, but he would prefer to rely upon rest and diet, belladonna externally and opium internally, believing and knowing that by such means the bulk of the cases are permanently cured. In exceptional cases, where these good results do not follow, and graver symptoms, increase of swelling and symptoms of peritonitis, appear, the surgoon's aid becomes of immense value, and certainly where these symptoms do appear, and there is a steady progression toward the bad, it is unquestionably time for the surgeon to take a hand. In all acute cases he does not question the right of the surgeon to interfere. As regards the propriety of operation between the attacks, his judgment would oppose it. He had seen many cases, in which even after a second attack, things have settled down and no further trouble developed. He advised that each case should be considered as a law unto itself, and the surgical interference is obligatory only when we find small chances of nature terminating the case favorably when guided by medical skill. With regard to the operation, he preferred the lateral incision, in some instances as far back as the line of the anterior superior spinous process and tending backward toward the loin. He deprecated too much disturbance of the parts in searching for the appendix, believing that better results can be obtained by irrigation and treating the wound by the open method. In conclusion, he pointed out the fact that all cases of typhilitic trouble and abscess are not due to the appendix, as some may be caused by the ulceration of the cæcum or foreign body, such as a bone or orange seed, cases of which he cited. During the stay of the visitors they were well entertained. Dr. John B. Roberts, President of the County Medical Society, gave them a reception, at which were present, Prof. Chiene, of Edinburgh, Dr. Wm. Gairdner, of Glasgow, and Sir William Mac Cormac, Mr. Thomas Bryant, Mr. Arthur Durham, Mr. Reginald Harrison, of London, to meet whom Dr. Roberts invited the members of the Society and physicians from other cities.

While speaking of societies, it is well to note that the gynecic imbroglio at the College of Physicians, which caused so much stir last spring and went so far as to cause the Board of Censors of the college to tender their resignations, has now been resolved and matters are now flowing in their accustomed peaceful channel. This was accomplished by the action of the college at its last meeting, when a resolution of censure was passed upon Dr. Joseph Price for expressing his private opinion of Dr. Penrose and other Fellows of the college somewhat too frankly, and the verdict of the censors that Dr. Price be requested to resign from the college was concurred in. It is understood that the censors have withdrawn their resignations, and Dr. Price shows no undue haste in offering his resignation, and probably will not do so at all. While the results of the commotion do not seem commensurate with the expenditure of force, or in other words, the amount of feeling that was stirred up, it is quite certain that the lesson will not be lost, and that the experience will be a salutary one in medical ethics, the good effects of which will be manifested hereafter.

The Pennsylvania Hospital will soon be enlarged; the managers having decided to erect another wing, which will add about 150 beds to its capacity. The new building will be upon the Spruce street front. It will be devoted to medical purposes and will have modern appliances for heating, ventilation, bathing, etc. The present buildings will probably be entirely surgical. The clinical hall will remain in its position between the present and the proposed buildings.

At his clinic, at the Pennsylvania Hospital, October 24, Dr. Thos. G. Morton exhibited the calvaria of a case of suicidal gun-shot wound of the brain. The young man was nineteen years of age, and was found in his room at a hotel with a bullet wound in his forehead, a little to the left of the median line. He was brought to the hospital at once, unconscious, and with right hemiplegia; he would occasionally lift his left hand to his head and grasp his hair as if in pain. Dr. Morton was out of the city at the time, and did not see him for two days. He found that a long probe could be passed directly through the left hemisphere until it met the parietal bone. Dr. Morton then trephined and found a softened collection as if the posterior convolutions had been churned up by the ball after it was checked by coming in contact with the inner table of the skull at this place. By inserting the tip of his little finger, he was enabled to detect the ball a short distance below the opening made by the trephine, and to subsequently remove it. The case was treated antiseptically, and a rubber drainage tube was passed directly through the brain along the track made by the bullet. The patient improved after the operation; he did not speak, but his eyes followed the movements of those about the room as if he were conscious. Three days later he died from exhaustion. Dr. Morton advocates the treatment of wounds of the

brain in the same manner as other wounds, by asepsis and drainage, and the use of the trephine if necessary to fulfill these objects. At the same clinic, Dr. Morton exhibited a calculus, cylindrical and tapering, resembling a thick date stone, which he had removed from the appendix vermiformis of a man, in the interval between attacks of appendicitis. The stone appeared to be phosphatic, and in drying became friable and easily separable into layers. The patient was also shown, having made a very prompt recovery. The operation was undertaken on account of the persistent tenderness remaining in the appendix region, and a hard object could be distinctly felt by deep palpation in this location.

At Jefferson Hospital, Dr. J. Solis-Cohen recently operated by Rouge's method for the removal of an epithelioma of the right middle turbinate body. The patient was a woman about sixty years of age. In this operation, the incision is made in the mucous membrane of the upper lip and the soft parts are separated successively from the bone and slid upwards so as to make a "death's head." The advantages are more freedom of access to the nasal chambers and absence of external cicatrix. The morbid growth, which was quite soft, was thoroughly scraped away and its base seared with the galvano-cautery.

A daily medical journal has commenced publication in Philadelphia, published by Dr. Jos. F. Edwards, the enterprising editor of the *Annals of Hygiene*. Subscription price, ten dollars per annum. The daily medical journal has frequently been discussed by medical editors and recognized as a long-felt want; but Dr. Edwards comes along and like a modern medical Columbus takes up the pullet's egg and smashing in the end, makes it stand alone and shows an admiring world how it may be done.

Section of Physiology and Dietetics.

To the Editor of the Journal of the American Medical Association:

Dear Sir:—The Section of Physiology and Dietetics should be a mirror of the present knowledge of the American Medical Association; those members who have any new points in physiology and dietetics will please send the titles of what they propose as their contributions to the common stock of knowledge. The officers of the Section could fill the whole time with papers and demonstrations, but this would infringe on others' rights and make it too much of an individual affair. There is no prescription of subjects, as this would be a restriction on the broad and open treatment that is due to workers in this department. Still practical points as to food will be very acceptable in the hope that better days as to diet may sooner dawn.

By order of Chairman, C. H. Kleinschmidt, M.D.
Ephraim Cutter, M.D., Secretary.
The Ariston, 1730 Broadway, New York, Nov. 5, 1891.

Codeine and Narcine.

Ed. The Journal:—I have read with much interest Dr. J. B. Mattison's paper on Codeine and Narcine vice Morphia. I write this note to indorse with emphasis every word Dr. Mattison says in favor of codeine over morphia. I have used codeine daily for more than fifteen years to the entire exclusion of morphia, and never had any one to form the codeine habit, and never increase the dose.

I am sir, very truly, CHAS. MANN.

BOOK REVIEWS.

DIAGNOSIS AND TREATMENT OF HÆMORRHOIDS AND OTHER NON-MALIGNANT RECTAL DISEASES. By W. P. AGNEW, M.D. Cloth, small 8vo, pp. 146. San Francisco: R. R. Patterson. 1891.

This book is principally devoted to recommendation of the treatment of hæmorrhoids by carbolic acid. The author's directions for making rectal examinations are excellent, and the author has given some valuable suggestions for treatment of these troublesome affections.

While the author's experience with carbolic acid is at variance with that of Andrews and others who have made a study of it, we cannot close our eyes to the fact that the "irregulars" are making the most of its use, and that there must be a much larger proportion of cures from it than is commonly supposed by the profession generally. It is really worth while to ask whether, in throwing away carbolic acid, we are not rather yielding to our disinclination to adopt anything from outside the professional pale.

We infer from frequent references to persons known to be "homœopathic," that our author belongs to that ilk, but nothing in the prescriptions, or the pathology, or the treatment, shows any heretical teaching of that sort, and we commend the book.

ESSENTIALS OF BACTERIOLOGY. By M. V. BELL, M.D.

This is one of Saunder's Quiz Compends, and one of the most useful of them. A small and comprehensive manual on bacteriological methods is a *sine qui non* to the student. This fulfills the demand.

OBSTETRICAL NURSING. By ANNA M. FULLERTON, M.D. P. Blakiston & Son, Philadelphia.

This little volume should have an extended sphere of usefulness. Detailed instruction on this subject is very essential to the prospective nurse who is attempting to grasp general principles simultaneously with practical matters gleaned from every-day experience.

MISCELLANY.

INTER-COUNTY MEDICAL SOCIETY.—The second regular meeting for the current year of the Inter-County Medical Society will be held at West Superior, Wis., in the parlors of the Broadway Hotel, Tuesday and Wednesday, November 10 and 11, 1891.

COMMITTEES.

Arrangements.—L. B. Shehan, Chairman; All Members at West Superior.

Practical Medicine.—J. B. Trowbridge, Chairman; S. L. Pickett, H. Hannum,

Surgery.—E. S. Hayes, Chairman; M. S. Hosmer, W. T. Rinehart.

Obs. and Dis. of Women and Children.—H. E. McIntyre, Chairman; H. V. Scallon, W. H. Ellis.

Special Gynæcology.—J. V. R. Lyman, Chairman; A. E. Bonneville, C. V. Beebe.

New Remedies and Therapeutics.—D. H. Decker, Chairman; W. T. Leonard, W. C. Pease.

Elementary Branches.—F. W. Epley, Chairman; J. A. Rene, H. B. Weiper.

Finance and Publication.—J. B. Trowbridge, Chairman; C. A. Hayes, D. H. Decker.

PROGRAMME.

The following is a partial list of subjects to be presented and discussed:

Tumors in Unusual Places, by Dr. C. A. Wheaton, St. Paul.

Familiar Talk on Gynæcology, by A. J. Stone, St. Paul.

Entero-colitis, by C. S. Beck, Jr., West Superior.

Fractures of the Skull, by E. S. Bacon, West Superior.

Appendicitis, with Report of Two Unique Cases, by W. E. Ground, West Superior,

Marginal Blepharitis, by D. D. Conkey, West Superior.

Crime an Evidence of Disease, by F. G. Sherwood, Superior.

Laparotomy; Report of Twenty-six Cases, by J. V. R. Lyman, Eau Claire.

Scarlet Fever, by A. F. Heising, Menomonie.

Errors of Refraction and their Relation to Headache and Other Reflex Neuroses, by F. R. Reynolds, Menomonie.

Appendicitis with Abscess, by S. L. Pickett, Wilson.

Acute Entero-colitis, by H. E. McIntyre, Hudson.

Fatal Chorea, by J. B. Trowbridge, Hayward.

Practical Remarks on Neurasthenia, by I. D. Wiltrout, Hudson.

Laparotomy and the early removal of Ovarian Tumors, based on result of Forty Cases, also Subsequent Symptoms, and the Cases indicating Drainage, by A. E. Bonneville, Ashland.

Urethritis, by J. A. Rene, West Superior.

WHITE OF EGG IN THE TREATMENT OF SORE NIPPLES.—F. Van Allen, M.D., writes to the *New York Medical Journal* of three cases in which he found white of egg, painted on sore nipples several times a day, entirely healed them in a few hours.

The albumen may best be applied just after nursing, while the nipple is still moist from the baby's mouth. As somewhat of a thick film is formed, it is well for the nipple to be moistened with a soft cloth dipped in water just before the baby is again put to the breast. The efficiency of the albumen is heightened by allowing it to dry on thoroughly before drawing the clothes again over the breast.

AUSTIN DISTRICT MEDICAL SOCIETY.—The seventeenth quarterly meeting of the Austin District Medical Society and joint session with the Central Texas Medical Association, will be held at Austin, Texas, Thursday, December 17, 1891.

Programme.—Morning session, 10 o'clock.

1. Address of Welcome.
2. Reading of Minutes.
3. Applications for Membership.
4. "Enteritis Simulating Bowel Obstruction," by Dr. Daniel Parker, of Calvert; discussion opened by Dr. J. M. Fraizier, of Waco, and Dr. W. A. Howard, of Waco, all of the C. T. M. A.
5. "Perityphilitis," Dr. W. R. Blailock, of McGregor, discussion opened by Dr. G. B. Foscue, of Waco, and Dr. W. E. Brown, of Gatesvile, all of the C. T. M. A.

Afternoon Session, 3 o'clock.

6. "Is Syphilis Transmitted Directly from the Father to the Child?" Affirmative: Dr. C. O. Weller, of Austin; Negative: Dr. W. T. Richmond, of Manor, both of A. D. M. S.
7. "The Management of Abortions," by Dr. J. W. Carhart, of Lampasas; discussion opened by Dr. T. D. Wooten, of Austin, and Dr. G. W. Christian, of Burnet, all of the A. D. M. S.
8. Voluntary Papers.
9. Verbal Reports of Cases.
10. Unfinished Business.
11. New Business.
12. Election of Officers.
13. Retiring President's Address.
14. Banquet at Night.

The Society will meet in Medical Hall, 513 Cong. Ave., and be called to order promptly at 10 A.M.

J. W. MCLAUGHLIN, President.
T. J. BENNETT, Secretary.

TO SAVE THE BABIES.—There are over one hundred babies born out of wedlock every month in the Public and Private Hospitals of Chicago. Nearly all of these babies are offered for adoption by their mothers when they are two or three weeks old, but being unable to give them away they place them in the baby farms or boarding houses to die of a slow death, or they dispose of them by other questionable methods.

Their mothers are not hardened criminals or women of the town. They are deceived young woman from our factories and workshops who have been led astray. Many of them are from country towns and have been sent to Chicago for hospital service.

The babies are generally two or three weeks old when offered for adoption. Most of them are healthy, strong babies, entirely free from inherited disease, black-eyed babies, brown-eyed babies, blue-eyed babies, blondes and brunettes, of every nationality, and they are finer specimens physically and mentally than the average run of children born in wedlock.

The Children's Aid Society of Chicago has undertaken the rescue of these babies from an untimely death, and they ask the coöperation and assistance of all practicing physicians. In case of the death of an infant anywhere in the country we ask that the attending physician will recommend to the bereaved mother that she adopt one of these babies and nurse it and raise it as her own. If the doctor will send immediately a description of the lost baby, we will duplicate it from the large number offered for adoption and send it by the next train to its new mother. The selection will be carefully made by a competent physician to secure a perfectly sound child.

The only expense to the receiver of the child will be the railroad fare of the nurse who brings the child.

Address the Children's Aid Society, P. F. Chase, Supt., Room 44, No. 204 Dearborn St., Chicago.

NEW YORK STATE MEDICAL SOCIETY.—The next meeting of the Medical Society of the State of New York will be held at Albany, February 2, 3 and 4, 1892. Dr. Seneca D. Powell, No. 12 West 40th street, New York; Dr. James D. Spencer, of Watertown, and Dr. Franklin Townsend, No. 2 Park place, Albany, have been appointed the business committee. Any communication regarding papers or any matter pertaining to the business of the Society which should properly come before the business committee, should be addressed to Dr. Seneca D. Powell, 12 West 40th street, New York City. A. Walter Suiter, president; F. C. Curtis, secretary.

Official List of Changes in the Medical Corps of the U. S. Navy, for the Week Ending November 7, 1891.

Surgeon Manly H. Simons, ordered to U. S. S. "Mohican."

Medical Inspector Frank DuBois, ordered to U. S. S. "Philadelphia."

Medical Inspector T. Woolverton, detached from U. S. S. "Philadelphia," and ordered before Retiring Board.

Asst. Surgeon N. J. Blackwood, detached from U. S. S. "Newark," and ordered to Navy Yard, League Island, Pa.

Asst. Surgeon C. DeW. Brownell, detached from Navy Yard, League Island, and ordered to U. S. S. "Newark."

P. A. Surgeon Philip Leach, detached from the Naval Academy, and ordered to U. S. S. "Monocacy."

Asst. Surgeon John E. Page, detached from the U. S. R. S. "Independence," and to the U. S. S. "Iroquois."

Asst. Surgeon James G. Field, detached from Bureau of Medicine and Surgery, and placed on waiting orders.